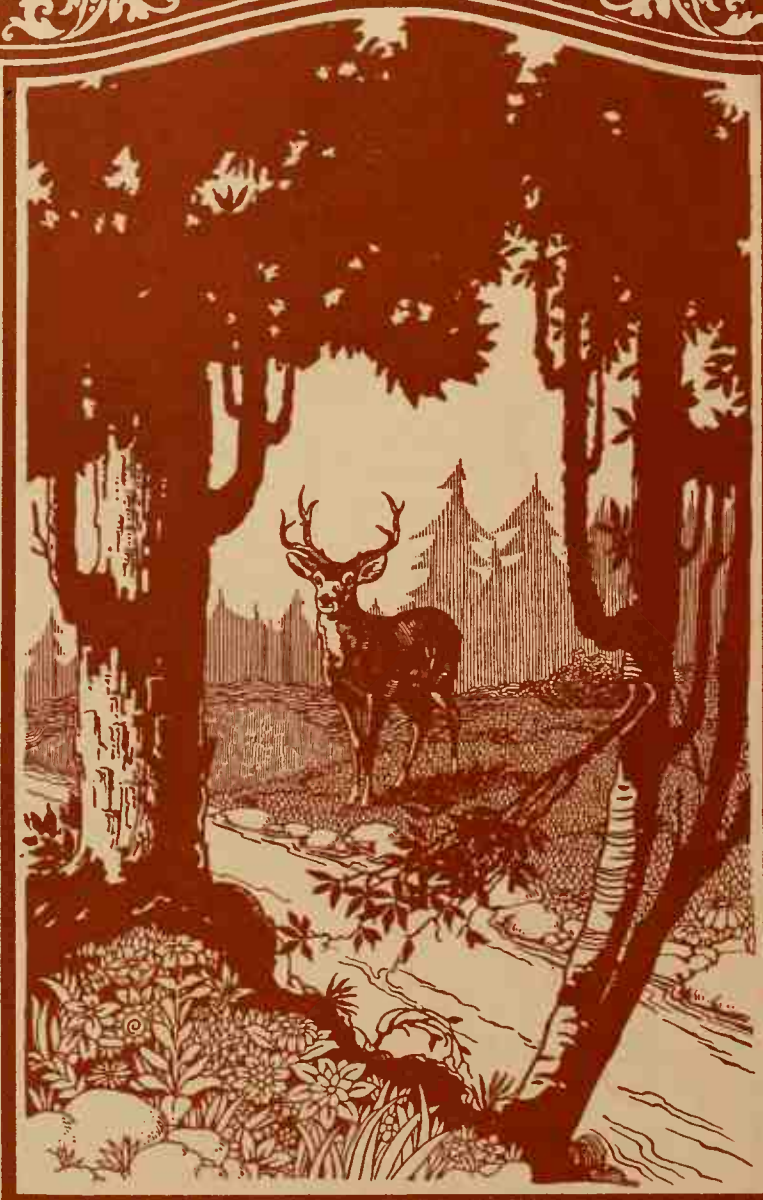

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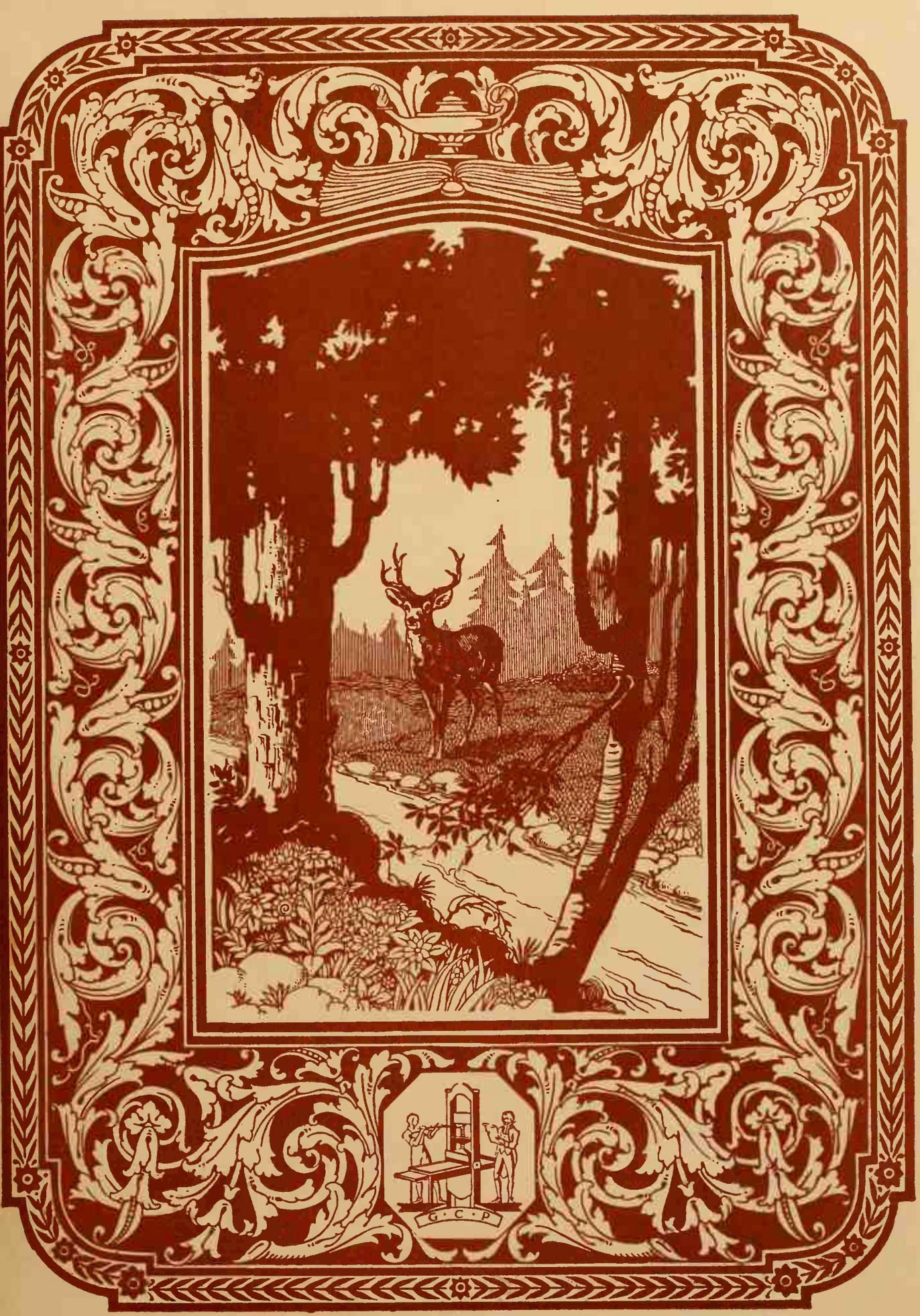
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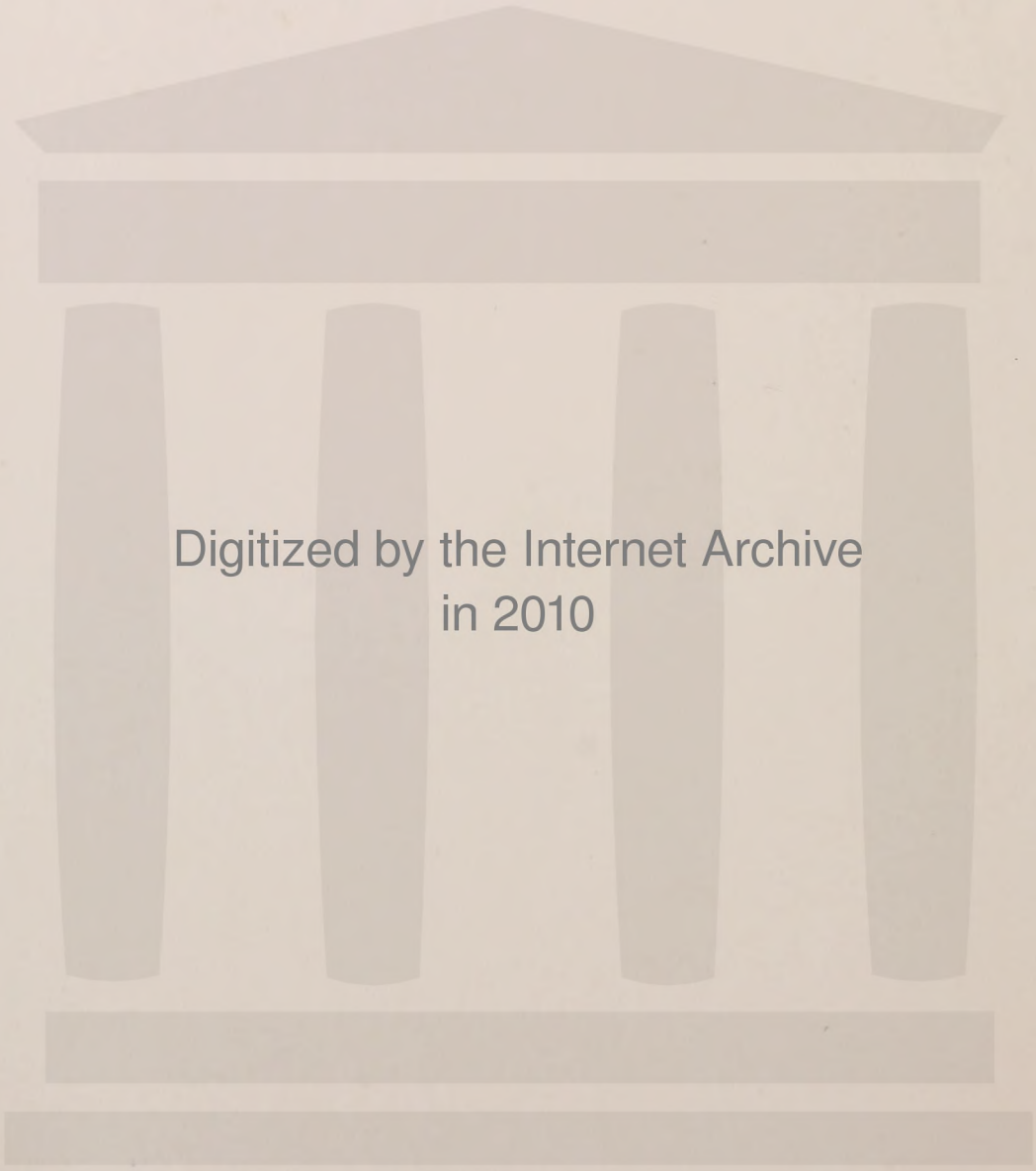
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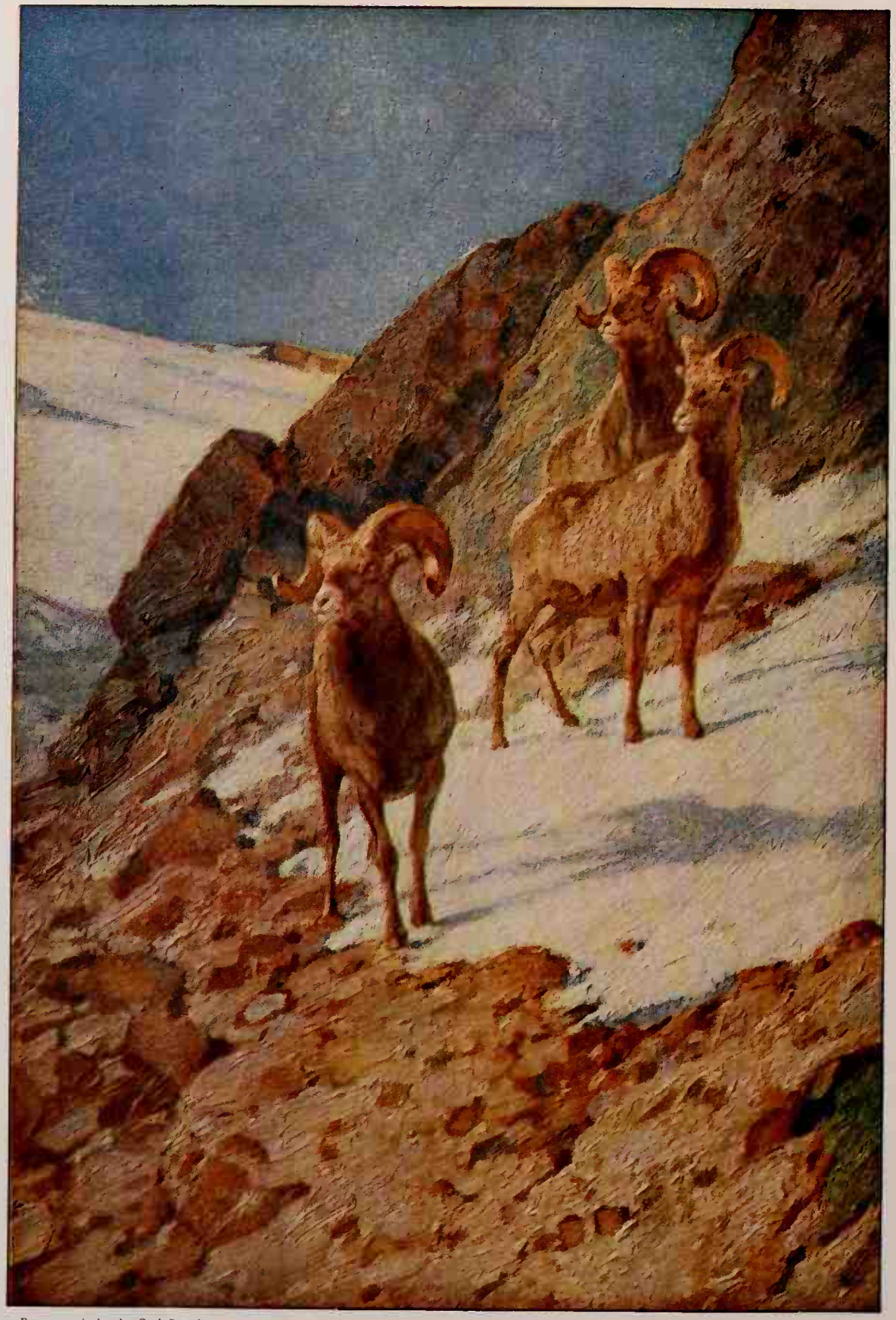

From a painting by Carl Rungius

BIGHORN SHEEP

Among the barren crags and dizzy slopes of the Rocky Mountains these sure-footed and wary animals have their homes.

ANIMALS OF AMERICA

"MAMMALS OF AMERICA"

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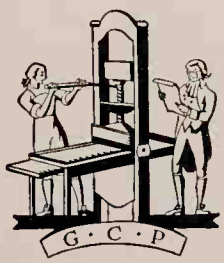

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PREFACE

IN preparing the text of "Mammals of America" two classes of readers have been kept constantly in mind — the inexperienced observer or layman who is yet fond of animals, and the trained naturalist or sportsman who wishes to supplement his field knowledge with exact book statement. The interest of both of these groups may be similarly keen, but their approach to the subject would necessarily be different.

Young people are naturally interested in all living things. From the house dog or cat to the zoological or circus animal, their attention is easily aroused and held. If in later years they do not keep their interest, it is because they have not been allowed to study the subject systematically, either in the classroom or at home. Natural History is, in fact, sadly neglected as a study, although one of the most fascinating of fields. Only the few become expert observers of animal life, while the many are content to learn the general aspects. For this reason, the ideal text-book should be so constructed that both groups of readers can turn to it with equal profit and pleasure. On the one hand should be set forth the picturesque and story-telling side of Nature — for that is the way she reveals herself to the casual passer-by — and, in addition, there should be system and accuracy of statement, in order to be of value to the advanced student.

This dual quality of popular and scientific treatment we have endeavored to obtain in "Mammals of America." We have presupposed no knowledge on the part of the reader; but at the same time have carried facts forward to a point of technical accuracy. In the introduction will be found the true starting point, in the question, What is a mammal? That defined, we next divide the mammals into orders, families, and species, and have, as it were, the framework of our structure. Turning now to the reading text we find the first order defined and followed by a diagram showing leading types of animals; and next come the animals under this order. The reader thus begins the book with a definite knowledge of the kinship of animals, which is essential to any study of types.

A word may be said as to why we begin with the Deer. The arrangement of the different orders and the sequence in which each animal is taken up, in most systematic works on mammals, follows the degrees of evolution. That is to say, the first mammals treated are the lowest in the evolutional scale and the work closes with the highest. If this conventional order of things were followed we should begin with the Marsupials and end with the Bats. But this arrangement has been set aside, in the present case, in order to secure an intensified interest on the part of the layman. By opening the volume with articles on the large, conspicuous ungulates it is hoped to secure a greater degree of interest on the reader's part from the very beginning.

The reading text itself is set in two styles of type. The smaller type at the top of each article is addressed to the more experienced observer who wishes to know exact facts. Here are given: (1) the animal's scientific name; (2) other names; (3) general description; (4) dental formula; (5) pelage; (6) measurements; (7) range; (8) food; (9) general remarks; and (10) related species. The larger type which follows gives a popular and story-telling description, of interest to every nature-lover, both young and old, and easily followed because of its avoidance of technical terms. But it is hoped that the interest there aroused will lead even

the younger readers to turn back to the scientific statement. Interest in the subject is further sought by the inclusion of many pictures taken from living animals, and, so far as possible, in the open. In a few instances animals were caged, and in a few others, pictures were made from mounted specimens. But the large majority are from field subjects obtained at the cost of infinite time and patience, and occasionally at the personal risk of the photographer.

A work of this sort is dependent in large measure upon the published works of authorities which have preceded it. The recent observations of naturalists and sportsmen are of highest value only when checked up with earlier field work. We append a bibliography of the chief sources so used for "Mammals of America," as a partial acknowledgment of our indebtedness; and wish to mention particularly the works of Allen, Audubon, Bailey, Coues, Elliot, Grinnell, Hornaday, Ingersoll, Lydekker, Merriam, Miller, Pycraft, Roosevelt, Seton, and Stone, there listed. We wish also to thank Messrs. Charles Scribner's Sons for permission to use quotations from Theodore Roosevelt's articles appearing in their magazine; Dr. William T. Hornaday, Director of the New York Zoological Park, for permission to use material from his books, and for suggestions and courtesies; Messrs. George H. Doran & Co., for permission to use material by Daniel J. Singer; and various officials of the American Museum of Natural History, and the United States Biological Survey for their interest and active assistance. Thanks are likewise due to various outdoor magazines such as *Outing*, *Field and Stream*, *The National Sportsman*, and *Recreation*, for permission to quote from articles and use pictures found in their pages.

To the many photographers and field observers all over the land, whose patient and adventurous work speaks for itself in the following pages, we can express but imperfectly the debt of gratitude we feel. They have brought home to us the secrets of forest, field and water — showing us as no amount of printed words could do the reality of the outdoor world. Literally years of effort have gone into these pictures which speak to us from almost every page. Wherever possible we have credited the name of the photographer on each picture. Special photographs were obtained from the New York Zoological Park, by Mr. E. R. Sanborn; the American Museum of Natural History, through Dr. G. Clyde Fisher; and the United States Biological Survey. A valuable series of pictures of moles, shrews, and rodents was obtained from the West Virginia University Experiment Station. The work of the photographers has been further supplemented with drawings by Carl Rungius, Belmore Browne, George A. King, and Henry Thurston. The attractive color note found on the title page was obtained from an original kindly loaned by the United Fruit Company.

Following the text proper, the reader will find a brief but useful glossary of scientific or unusual words; a bibliography of sources already alluded to; and an index referring to the several hundred species by scientific name, common name, and other local names, so that even if only one name of an animal is known, it may be possible to turn at once to the page where it is described.

INTRODUCTION

WHAT is a mammal?

The beginner in any study has certain basic facts to acquire, and this is never more true than in an exactly related science such as natural history. It is absolutely necessary to begin here by mastering a few of the broad, underlying principles, in order to follow the subject diligently. These are not difficult to follow, if the reader takes them up one at a time in regular order; and the first question that would naturally arise in the present volume is, What is a mammal? To answer it, let us turn back for a moment to the beginning of animal life. All living animals fall under one of two heads, or kingdoms, as the naturalist calls them, the *Invertebrata* and the *Vertebrata*. The *Invertebrata* are the lowest forms of life, and are so called because of the fact that they lack a backbone, or spinal column. To this kingdom belong the hosts of creeping, crawling animals such as Worms, Insects, Molluscs, Sponges and Jellyfish.

The Vertebrate kingdom contains the higher types of life, beginning with such lowly forms as the Lancelets and Tunicates, and running upward in the scale to Man himself. The Vertebrates are characterized by the possession of a backbone, which is cartilaginous in the lower animal types, but formed of true bone in the higher. This kingdom may be divided into five divisions or classes, viz., the Fishes, the Amphibians, the Reptiles, the Birds, and the Mammals.

HOW MAMMALS DEVELOPED

Mammals are thought by competent authorities to have been developed from reptilian ancestors. They hold this belief because fossil reptiles of a highly specialized type have been found possessing mammal-like characters. The theory, in brief, is that from some very active, highly specialized reptile of this type, the first mammal was evolved at an early period. Mammals, however, are not an ancient class, when compared with other Vertebrates, for it is almost certain that the Mammals and the Birds are the latest arrivals of all.

Mammals differ from other Vertebrates mainly in the following characters: the possession of hair, mammary glands, a high blood temperature, a four-chambered heart, a diaphragm, a highly developed brain and nervous system, and also some very important characters in the skeleton. Probably the best-known character is the possession of hair to a greater or less degree, varying from coarse bristles to finest fur. This form of outer covering is opposed to that of other classes. For example, the Birds have feathers, the Reptiles scales, the Amphibians are generally naked, and the Fishes have scales.

A very important character of the Mammals, the one that gives the class its name, is the presence of mammæ, or breasts, on the female. These structures are necessary because Mammals bear their young alive and helpless, and they must be fed by the mother until strong enough to take care of themselves. In the other classes the young more often come from an egg, or, if born alive, are more or less able to shift for themselves.

The high blood temperature and the four-chambered heart are most valuable to the Mammals. Because of this fact alone they would be able to dominate the other classes. Long periods of sustained activity are possible only through a warm and consequently active blood stream. In all the other classes, except the Birds, the members have what is commonly called cold blood, or, to speak more exactly, a variable blood stream. This results in long dormant or sluggish periods. The warm-blooded Birds, on the other hand, lack the

more highly developed heart of the Mammal. The diaphragm, a typically mammalian structure, is a thin muscular wall separating the cavity containing the lungs and heart from the other internal organs. This separation results in a better opportunity for the functioning of the various organs, and is a development upward. Finally, the brain of the Mammal is marvelously developed and is far in advance of that of members of other classes. The increase is in both quantity and quality, in volume proportionally to the weight of the animal, and in the development of the higher centers and convolutions.

SUBDIVISIONS OF MAMMALS

Now with a better idea of what a Mammal, any Mammal, is, the next step is to see how its different members differ from one another. Students have divided the class *Mammalia* into two large divisions, based upon the degree of development; the least developed belong to the *Prototheria*, or ancient Mammals, while the more highly developed forms belong to the *Eutheria*, or modern Mammals. The *Prototheria* are represented today by only two types, the Duckbill Platypus, or *Ornithorhynchus*, and the Spiny Anteater, or *Echidna*, both very strange-appearing animals to be found only in Australia and neighboring islands. They lay eggs, but otherwise more closely resemble true Mammals than any other class, although they are connecting links with the lower animals. We are concerned only with the *Eutheria*, since all the North American Mammals belong to this subdivision.

Because of the wide diversity of types it was early found that, in order to make anything like a close study of Mammals, a careful classification must be arranged. This classification has been built up on names formed on Latin and Greek roots. The reason for this becomes evident when one learns the difficulty of trying to do anything with the so-called common names of Mammals. For example, the English-speaking settlers of North America brought over Old World names with which they were familiar, and applied them to New World Mammals with which they were not familiar. The result is that such animals as the American Elk and Buffalo have received these names from a fancied identity with Old World animals, while as a matter of fact these names are misleading and should apply only to the much different animals on the other side of the Atlantic. The common name of " Gopher " is variously used in different localities for Ground Squirrels, Chipmunks, and Pocket Gophers, and consequently means nothing in an exact treatise, whereas the scientific name of an animal means the same the world over. Thus the classification which at first appears to be cumbersome and unnecessary is seen to be absolutely essential to a clear understanding of the Mammals from widely separated localities.

HISTORY OF CLASSIFICATION

Attempts at classification were made in very early times. One of the earliest of these is contained in *Leviticus* XI, where Mammals are classified into those that divide the hoof and chew the cud, and the Camel, the Cony and the Hare are enumerated among others. The early Assyrians (about 668 B. C.) made an evident attempt to classify into divisions like our modern families and genera, for they put the Dog, Lion, and Wolf into one category and the Ox, Sheep and Goat into another. The history of classification begins with Aristotle (B. C. 384–322) who was a good observer and compiler, but who has commonly been credited with ideas more advanced than were actually the case. He uses the words genus and species. Following Aristotle comes a long lapse of time wherein nothing of great importance was added to the classification of animal life. Gesner (1551–1558) and Wotton (1552) are the landmarks for the 16th century. Ray (1693) began with the method of the Greeks, but left a method that marks most decided advances. His tables of classification chose characters of more fundamental value, and he discarded the habitat or home of the animal as a means of classification. Earlier writers made up groups into Terrestrial, Aquatic, and Amphibious, regardless of the true relationships of the animals. For example, the Seal and the Frog are both

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MULE DEER

This attractive picture is the more interesting because it shows the Deer's antlers in the velvet, or immature stage

Amphibious, but are far apart in true relationships. In addition Ray designated many terms that are in use today such as *Carnivora*, *Ungulata* and *Insectivora*.

The real foundation of modern scientific classification is found in Linnæus (1707–1778). His *Systema Naturæ* passed through twelve editions; beginning in 1735 as a mere brochure of twelve pages, by the time the twelfth edition was published, in 1766, he had so added to it that it was a work of 2400 pages. The *Systema Naturæ* is an orderly treatment in a systematic manner of the entire animal kingdom as then known. The analysis is philosophical, the diagnoses clear and workable, and the details quite generally correct. The modern designation of an animal by two names (the lion = *Felis leo*) goes back to Linnæus. He coined the word "mammal" and made the possession of mammae a character of the entire class. This brought together in a single class for the first time the terrestrial hairy quadrupeds and the whales. Man was placed among the *Primates*, where he belongs. After Linnæus, Erxleben (1777), Buffon, and Daubenton (1753–1767), Geoffroy St. Hilaire and G. Cuvier (1795), Cuvier (1796–1836), De Blainville (1816, 1834), Darwin and Huxley, Owen (1868), Gill (1870), Cope (1891, 1898) and Weber (1904) are the most important workers among a number of earnest students of animal life. The later steps are mainly the result of a better knowledge of anatomy, an increased amount of material for study, and the refinement of scientific methods in general.

ORDERS AND OTHER GROUPS

The scientific classification of today is based upon a progression of subdivisions beginning with the class and ending with the species and sub-species. The class is subdivided into sub-classes, the members of each sub-class having some group of important fundamental characters in common. The next subdivision in rank is the order, which is itself a very large group, then next in importance follows the sub-order, beneath that the family and sub-family, the genus and sub-genus and finally the species and sub-species. The following diagram illustrates this arrangement better than a written description.

CLASS — MAMMALIA = MAMMALS

Sub-class – Eutheria = Modern Mammals

Order — Marsupialia = Marsupials, or Pouched Mammals.
Order — Edentata = Sloths, Armadillos, etc.
Order — Ungulata = Hoofed Mammals.
Order — Sirenia = Manatees, Dugongs.
Order — Cetacea = Whales, Porpoises, Dolphins.
Order — Rodentia = Rodents.
Order — Carnivora = Flesh-eating Mammals.
Order — Insectivora = Insect-eating Mammals.
Order — Chiroptera = Bats.
Order — Primates = Lemurs, Monkeys, Apes, Man.

The above carries the classification through all the mammalian orders of the world. Each order in turn is subdivided in much the same manner as the following diagram:

Order — Rodentia.
Sub-order — Simplicidentata = Rats, Squirrels, etc.
Family — Muridae = Rats and Mice.
Sub-family — Microtinae = Meadow Mice, Voles.
Genus — Microtus = Common Meadow Mice.
Species — pennsylvanicus = Eastern Meadow Mouse.

This diagram shows how the subdivision passes from the larger to the smaller group until finally a group is reached that contains only a single, particular kind of Mammal, and this group we call a species. Of course it is obvious that each of the larger groups may have more than one of the lower groups. Every Mammal has a similar place in the scheme, but always its relationships to any other Mammal are shown by the fact that the two will be included in some common group, if the groups are followed back far enough.

Thus we see that the Eastern Meadow Mouse and the Varying Hare can claim no closer relationship than that expressed by inclusion in the same order, a rather distant relationship. The higher the rank of the first including subdivision, the more remote the immediate relationship of any two Mammals. In common practice the sub-groups, like the subfamily, sub-genus, and sub-species are often omitted, although with the knowledge that these groups exist, the full divisions themselves expressing all the ordinary needs of relationship.

SCIENTIFIC NAMES

For convenience sake and to show the authority for a name, it is customary to place after a scientific name the name of the man who first described the animal. Thus, the scientific name for the Eastern Meadow Mouse is written *Microtus pennsylvanicus* (Ord). This means that Ord first gave a name to the animal we know as the Eastern Meadow Mouse; while the parenthesis about his name indicates that the name has been somewhat changed by some later authority from its original form. Ord called the animal *Mus pennsylvanica* not knowing that the name *Mus* was first used for a different animal, an Old World rat, and consequently could not be used for the American animal too without creating confusion; therefore, a later worker straightened out the confusion and put parentheses about Ord's name to indicate the change. No parentheses means that nothing has been changed, and that the name stands as its author first wrote it.

EVOLUTION A CONSTANT FACTOR

The real necessity of a classification arises from the plastic nature of animal organisms. If the Mammal were not the plaything of its environment, we should not have a multitude of different mammals, and consequently we should not be at a loss to find names and

relations for the thousands of varied forms about us. Evolution is a constant factor in the animal world. No matter how biologists may differ about the modes of evolution, nowadays none of them will refuse to admit that changes have taken place in the different animal structures. Evolution may be either progressive or retrogressive, resulting in specialization or degeneration.

Evolution is expressed in a multitude of ways. The hair, the structure that on the Rabbit is so soft and flexible, through specialization becomes the quill of the Porcupine, a complex structure very little like the hair from which it has been evolved. This is called specialization through change in form. The difference in the character of teeth, such as the flat grinding tooth of a cow and the sharp shearing tooth of a cat, is a specialization of this sort. Another type of specialization results in the loss of parts. This is illustrated by the evolution of the Horse from a little five-toed animal of an older geological epoch into a one-toed animal of today. Specialization that results in the increase or addition of parts is seen among the bats, where many complex structures on the nose and in the ear occur. Minor changes in Mammals are to be seen on every hand. Such changes are those in the colors of the pelage to suit the environment, the increase or decrease in size of a species to suit the food supply, and the growth of special areas of hair, like the tufts on the ears of the Lynx.

Just exactly how all these changes are brought about is a fruitful source of argument among students of biology, but two main factors are currently recognized, namely, heredity and the effect of environment. Heredity might be construed as the result of an earlier environment which then would make environment the main factor. Certainly a close connection can almost always be established between an animal's structure and its environment. As a result of the competition among animals, bringing into operation the principle of "survival of the fittest," the Mammals have spread out into every conceivable environment, every possible economic niche opened up to them by nature. We find Mammals of different orders occupying the same niche; but generally when a Mammal has thoroughly mastered its environment, its advantages are such that an intruder cannot meet it in active competition and survive the encounter. "Adaptive radiation" is the name given to this spreading out of a certain type of Mammal life. Rodents, for example, have become specialized to the point that we find them living successfully as typical terrestrial animals (the Chipmunk), as semi-subterranean (the Ground Squirrel), as wholly subterranean (the Pocket Gopher), as aquatic (the Beaver), as arboreal (the Gray Squirrel), and finally as semi-aerial (the Flying Squirrel). In this same order, the method of locomotion has passed from the typical running on all fours to swimming, to crawling in restricted burrows, to leaping kangaroo fashion with the hind legs alone, and to gliding like an aeroplane.

The distribution of Mammals has become very general because of this adaptability to environment. Mammals becoming accustomed to cold climates have extended their ranges until some species are found under the Arctic Circle and on the highest mountain peaks where intense cold reigns. On the other hand, desert Mammals have pressed into the heart of the most arid, hopeless wastes of sand. Food seems to be the only requirement necessary, lack of water and cover seeming to have little effect. As a rule, the largest and best-developed fauna, however, is to be found where conditions are most suitable.

REQUIREMENTS FOR STUDY

The requirements for the study of Mammals are primarily few, and most of us already possess them. The average child has a keen interest in the life about him and ordinarily in the process of growing up acquires considerable knowledge of the commoner animals of his vicinity. Given the interest, a sharp eye and an acute ear are material aids of first importance. Observations often need to be interpreted, the interpretation not infrequently calling for the skill and experience of the zoologist. Many things to be noted, however,

Photograph by Mrs. Howard A. Colby

AN AFTERNOON SIP

Bull and Cow Moose, at Longley Lake, Maine, on the last day of September. Differences in build of these two animals are well shown

are so self-evident that every one sees the meaning, and thus upon observation depends the extent of the individual's study. Observation, reading, and scientific method are the student's trinity. Some Mammals lend themselves readily to observation, as, for example, the Squirrels and Hares; while others require more skill in pursuit, but yet may be watched if moderate pains be taken, the Pocket Gophers and Woodchucks coming into this category. Still others, although not particularly rare, are difficult to observe, and experienced students live a lifetime without adding much first-hand knowledge to their store; such common Mammals as Bats and Moles having little-known life histories to this day. Lastly, the method gained by the study of a systematic account of Mammals, or any other class of animal life, will never be regretted in any pursuit, or at any time, for, cloaked in an entertaining garb, the basic principles that underlie all sciences have been introduced to the student, and as a consequence he should be the gainer in accuracy of observation, interpretation, and well-rounded knowledge.

H. E. ANTHONY

Photograph by H. A. Colby

SURPRISED

An actual photograph of a flashlight exposure, showing how night pictures of Deer and other animals are obtained

AMERICAN GAME PROTECTION

By T. S. Palmer

Of the U. S. Biological Survey

GAME protection in the United States has been gradually developing during a period of nearly three hundred years and has been marked by an immense volume of legislation. In no other country in the world have laws for the protection of game been passed in such numbers or amended so frequently.

The history of the development of the complex game laws of today from the simple provisions of colonial times is both interesting and valuable in showing the numerous experiments which have been tried and have resulted in failure, and in throwing light on present problems. Many provisions, such as restrictions on sale and export, considered recent, are in reality very old; while, on the other hand, legislation prohibiting spring shooting of waterfowl and summer shooting of woodcock and shore birds is comparatively recent, owing in large measure to the generally accepted, but erroneous, idea that migratory birds require little protection and may be shot as long as they are present in spring and as soon as they appear in late summer. The earliest game laws were probably the fowling and hunting rights conferred, in 1623, on the Plymouth colonists in Massachusetts; the hunting privileges granted, in 1629, by the West India Company to persons planting colonies in New Netherlands; and the provisions regarding the right of hunting in the New Jersey Concessions of Agreements of 1678. The succeeding years may be conveniently divided into two periods of approximately equal length — a colonial period and a modern period. The latter period is the more important and the one with which we are mainly concerned. In the century and a third since the Revolution a vast number of experiments have been made in game protection.

GAME LAWS IN THE 18TH AND 19TH CENTURIES

At the end of the colonial period twelve colonies had enacted game laws. Close seasons had been provided for deer in all the colonies except Georgia; and for wild turkeys, heath hens, partridges, and quail in New York. Several of the colonies had laws prohibiting hunting on Sunday or hunting with fire at night. Massachusetts in 1710 prohibited the use of boats or canoes with sails, or canoes disguised with hay, sedge, or seaweed for hunting waterfowl. Restrictions on the export and sale of deerskins were also in force in some of the colonies. The beginnings of the warden system had been made in Massachusetts and New Hampshire about the middle of the eighteenth century, but these comparatively few statutes were all that were considered necessary.

By 1850 comparatively little game legislation had been enacted, although the list of States having such laws had increased to nineteen, which included the thirteen original States and Maine, Vermont, Florida, Alabama, Mississippi, and Indian Territory. The only game law in force west of the Mississippi was the restriction on hunting on Indian lands. No protection for non-game birds was provided until the passage of the first laws protecting insectivorous birds in Connecticut and New Jersey in 1850.

In the decade from 1851 to 1860 game laws were passed for the first time in twelve States, increasing the total number to thirty-one. These States included Illinois, Indiana, Michigan, Ohio, and Wisconsin, east of the Mississippi River; Minnesota, Iowa, Missouri, Nebraska, and California in the West; and Louisiana and Texas in the South.

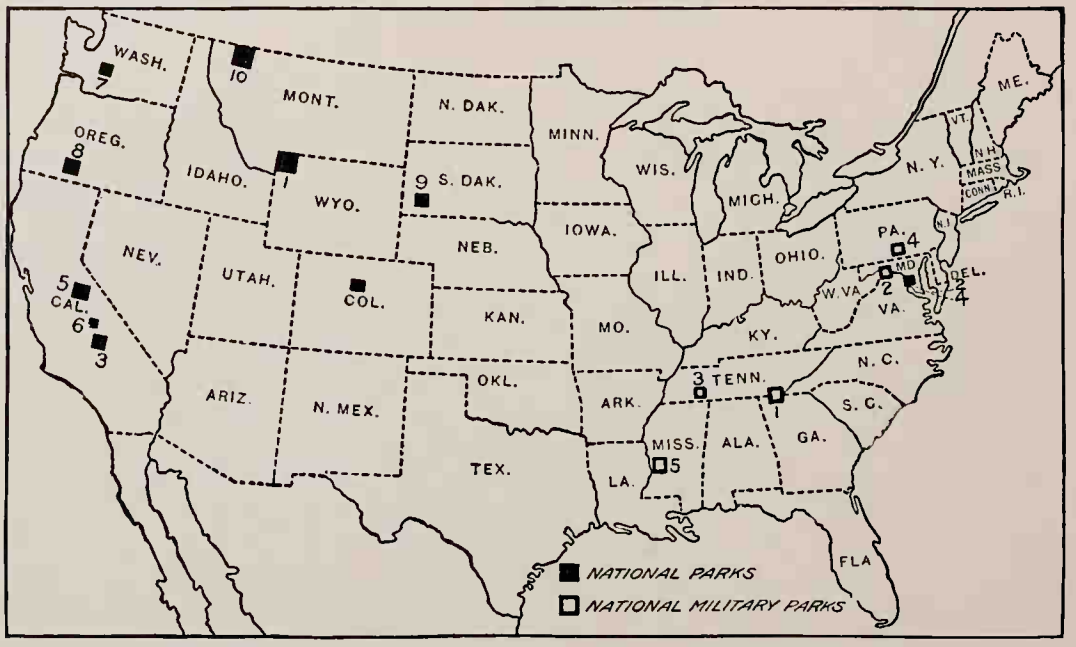
In the decade from 1861 to 1870 the list of States was still further increased by ten. The chief advance was in the Rocky Mountain States — in Colorado, Montana, and Wyoming; farther west in Nevada and Washington; and in the middle West in Kansas, Kentucky, Tennessee, and West Virginia.

In the decade from 1871 to 1880 the progress of game legislation extended to forty-eight States by the addition of North and South Dakota, Utah and Oregon in the West; Arkansas and New Mexico in the South; and the District of Columbia in the East.

In the decade from 1881 to 1890 the first game laws were passed in the Territories of Arizona and Oklahoma.

FEDERAL LEGISLATION

The decade from 1891 to 1900 was marked by the first real Federal legislation. In 1900 the earliest game provision for Alaska was incorporated in the Alaska Civil Code, although the first general game law for the Territory did not pass until 1902. The year 1900 also



MAP SHOWING NATIONAL PARKS AND GAME RESERVATIONS

marked the final passage of the earliest general Federal statute, commonly known as the Lacey Act, which became a law after being under consideration by Congress for three years. Since 1900 a number of new State restrictions have been placed on the statute books, among which may be mentioned the prohibition of the use of automatic guns (Pennsylvania, 1907) and silencers (Maine, North Dakota, and Washington, 1909). The propagation of game has received widespread attention through the so-called "More Game movement," inaugurated in 1908.

New impetus was given to game protection through the establishment of sportsmen's journals in the early seventies, and this movement was almost immediately reflected in an increased volume of legislation; so that during the last three decades of the century the number of laws rapidly increased.

STATE CLOSE TERMS

Early in the history of the country, in some localities where game was becoming exterminated, hunting was suspended for a term of years in order to afford opportunity for recuperation. These close terms were later extended to so many States that in some cases

Photograph by C. F. Greenleat

A GROUP OF NORTH AMERICAN BISON

This photograph was taken in the Rocky Mountains Park, Canada, and shows part of the Canadian national herd. The majestic bull at the right is "Sir Donald." At the time his portrait was obtained he was thirty-four years old and the only living North American Bison captured from a wild herd

a species received absolute protection throughout its range in the United States. The first close terms were apparently those for deer for three years in Massachusetts, 1718, and four years in Virginia, 1772. Comparatively few close terms for quail have been established in States well within the range of the species, although such periods are common in localities where birds have been introduced, or reach the border of their natural range, and where they are likely to be winter killed. In the case of doves the species was first removed from the game list in Connecticut and New Jersey in 1850, and this bird has since been given complete protection in about a third of the Northern States, although in the South and Southwest it is still retained on the game list.

By the establishment of a close term on caribou in Minnesota in 1905, the last State which had any of this game was closed to hunting, and caribou were practically removed from the game list in the United States. Close terms for antelope have likewise been extended and adopted by successive States until in 1909 they covered the entire range of the species, thus practically removing antelope from the game list.

The completion of the Union Pacific Railroad in 1868 determined the fate of the buffalo. The species at that time was distributed chiefly on the Great Plains region between the Missouri River and the Rocky Mountains, although a few individuals may have ranged west of the mountains. The only State which afforded the species any protection was Idaho. The building of the railroad not only divided the buffalo into two great herds, a northern and a southern, but gave ready access to the hunting grounds and afforded easy means of shipment for hides. For a time the slaughter raged almost uninterruptedly, and in six years the southern herd was almost exterminated. With the completion of the Northern Pacific Railroad in 1881 the fate of the northern herd was sealed; the last survivors were destroyed seven years later.

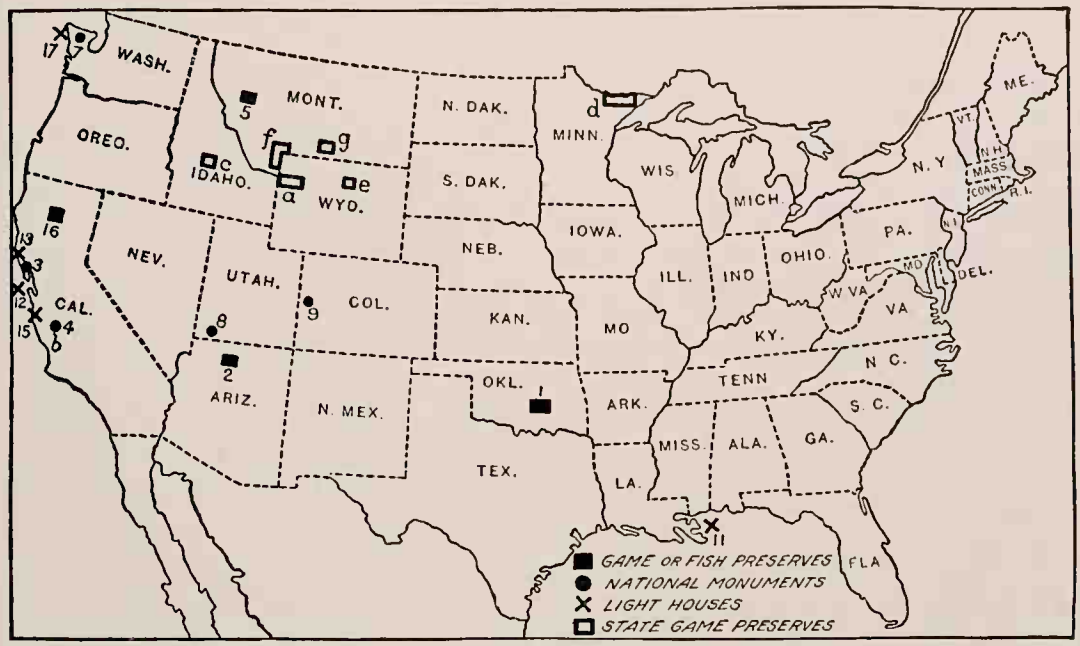
It is interesting to note that a close season on buffalo was first established in Idaho in 1864, and in Wyoming in 1871, followed by Montana in 1872, Nebraska 1875, Colorado 1877, New Mexico 1880, and North and South Dakota 1883. With the building of the Kansas Pacific, and the Atchison, Topeka and Santa Fe railroads in the early seventies, an important trade in buffalo hides and meat arose at several points in southern Kansas, notably at Dodge City, Leavenworth, and Wichita. From these centers persistent and concerted attacks were made on the southern herd, and so long as buffalo killing remained profitable it was impossible to secure any legislation which would interfere with the traffic. With the disappearance of the southern herd about 1874 the need for a close season vanished. Briefly stated, not the slightest protection was afforded in the way of legislation in the States in which buffalo were most abundant and in which, through its accessibility, the species was most quickly exterminated.

The enormous flocks of wild pigeons which formerly darkened the skies in the States of the upper Mississippi Valley, New York, and southern New England had already begun to decrease by the middle of the last century. The last great nesting in New York occurred in 1868, the last large roosting in 1875, and the last great nesting in Michigan — probably the last anywhere on the continent — in 1878. During the time of abundance no serious effort was made to protect the birds. The first legislation on wild pigeons seems to have been an act passed in Massachusetts in 1848, which, instead of protecting the birds, protected the netters against molestation in carrying on their business. In 1857 a committee of the State Legislature of Ohio in their report on a game bill declared: "The passenger pigeon needs no protection. Wonderfully prolific, having the vast forests of the North as its breeding grounds, travelling hundreds of miles in search of food, it is here to-day and elsewhere tomorrow, and no ordinary destruction can lessen them or be missed from the myriads that are yearly produced."

The last wild pigeon in Ohio was killed in 1900, and a few years later the sole survivor of the species known, a captive bird, died in the gardens of the Zoological Society of Cincinnati, Sept. 1, 1914.

It is sometimes said that game legislation will not save a species from destruction, and this fact is shown by the history of the buffalo and the pigeon. The most casual examination of their history will show that game legislation played no part in the fate of these species. A close season during the period of reproduction was denied them until too late, and even then there was little serious attempt to enforce the laws.

One of the most important features of the work under the Federal law has been co-operation with State officials and aiding them, so far as possible, in their efforts to secure more effective laws and solve the numerous problems which constantly arise in game-law enforcement. Thus in Massachusetts the game commission has been placed in possession of facts relating to the protection of non-game birds and the restriction of sale of birds for milli-



MAP SHOWING NATIONAL AND STATE GAME PRESERVES

nery purposes. In Pennsylvania the secretary of the game commission has been supplied with information on various matters of legislation and game protection; in Delaware the State Game Protective Association has been aided in securing more effective laws; and in Maryland and North Carolina the State authorities have been furnished summaries of the local laws and annual posters showing the close seasons for game in each of the counties of these States. These are merely illustrative examples.

WORK OF THE AUDUBON SOCIETIES

The most important factor in the protection of non-game birds in the United States has been the work of the Audubon Societies. In educating the general public in the economic value of birds and in creating public sentiment in favor of bird protection, these organizations have met with remarkable success, and their educational work has paved the way for still more successful efforts in securing the adoption and enforcement of uniform laws and in specific measures for bird protection.

However successful the Audubon societies may have been in their efforts to secure legislation, their practical work of enforcement has been more effective. Though the aid of funds, raised chiefly by popular subscription, protection has been extended to all the important colonies of sea birds breeding along the Atlantic coast from Maine to Chesapeake Bay, on the coasts of North Carolina, Florida, and Louisiana, and at certain points in

Oregon. Wardens paid by the society have patrolled these colonies during the breeding season and insured the birds against molestation. The National Association of Audubon Societies has also caused various localities to be examined, and has in each case taken the initial steps which have led to the establishment of Federal reservations thus far set aside by Executive proclamation. In the maintenance of the warden service on these reservations it has also taken an important part.

GAME RESERVATIONS

During the past forty years numerous reservations have been created by the Federal Government which directly or incidentally protect wild life. The largest and best known is the Yellowstone National Park, established by act of Congress on March 1, 1872. Although usually considered the first, it is not as old as several lighthouse reservations which in recent years have become important refuges. Since 1872 other national parks have been set aside, military parks have been established on famous battlefields, national monuments have been created for the protection of objects of scientific interest, and bird reservations have been set aside for the protection of breeding grounds of waterfowl and other birds. Some of these reservations, including the military parks and some of the national monuments, although established primarily for other purposes, afford refuges for birds and game. These reservations are under the jurisdiction of five departments of the Government, the Smithsonian Institution, and the District of Columbia.

Notwithstanding the apparently large numbers of refuges, their combined area is relatively small. The total area of the national parks and military parks, which serve as game refuges, is less than 5,000,000 acres. The only other large refuges are the Grand Canyon and Wichita Game Preserves, the Colorado, Mount Olympus and Mukuntuweap National Monuments, the Montana National Bison Range, the Superior National Forest, and parts of the Absaroka, Boise, and Teton national forests which have been made State game preserves; and bird reserves, such as Klamath, Malheur, Niobrara, and Yukon Delta. Most of the refuges are on waste, mountain, or marsh land, or on small islands of no agricultural value. When compared with the series of extensive parks and game preserves created in Canada in recent years or the still more extensive game preserves in the British colonies in Africa, the area devoted in part to the increase of wild life in the United States is still very small.

Following is a complete list of our national parks as reported by the Department of the Interior, with date of their creation, and area in square miles:

National Park	*Location*	*Date*	*Area, sq. miles*
Hot Springs	Middle Arkansas	1832	1½
Yellowstone	N. W. Wyoming	1872	3,348
Yosemite	Middle Eastern California	1890	1,125
Sequoia	Middle Eastern California	1890	237
General Grant	Middle Eastern California	1890	4
Casa Grande Ruin	Arizona	1892	1
Mount Rainier	West Central Washington	1899	324
Crater Lake	South Western Oregon	1902	249
Wind Cave	South Dakota	1903	16½
Sullys Hill	North Dakota	1904	1½
Mesa Verde	South Western Colorado	1906	77
Platt	Southern Oklahoma	1906	1⅓
Glacier	North Western Montana	1910	1,534
Rocky Mountain	North Middle Colorado	1915	358
Lassen Volcanic	California	1916	124½
Hawaii	Hawaii	1916	117½
Mount McKinley	Alaska	1917	

WILD LIFE IN THE PARKS

Most of these parks have more or less big game, and this element of the fauna is probably the one of the most general interest. The General Grant and Wind Cave Parks have little or no native big game, but a movement was started several years ago to utilize the latter as a game preserve, and the park is now stocked with buffalo, elk, and antelope. The National Zoological Park in Washington, D. C., contains one of the largest collections of living animals and birds in the United States, and is especially rich in native species. The Yosemite and Sequoia Parks have little big game beside deer and bears, although the Sequoia has a few mountain sheep (recently described as a new species) on some of the higher peaks and a small herd of dwarf elk in an enclosure on the Kaweah River. Crater Lake and Mount Rainier have deer, bear, and beaver. Mount Rainier has also a number of mountain goats, and Glacier Park, beaver, deer, elk, moose, sheep, and many goats and bears.

The Yellowstone Park has by far the greatest herds of big game, including antelope, mountain sheep, buffalo, deer, moose, bear, and beaver, and the largest herds of elk on the continent. A recent document issued by the Department of the Interior contains these interesting paragraphs in regard to the wild life of the Yellowstone: "It is the largest and most successful preserve in the world. Its 3,300 square miles of mountains and valleys remain nearly as nature made them, for the two hundred miles of roads and the five hotels and many camps are as nothing in this immense wilderness. No tree has been cut except when absolutely necessary for road or trail or camp. No herds invade its valleys.

"Visitors for the most part keep to the beaten road, and the wild animals have learned in the years that they mean them no harm. To be sure, they are seldom seen by the people filling the long trains of stages which travel from point to point daily during the season; but the quiet watcher on the trails may see deer and bear and elk and antelope to his heart's content, and he may even see mountain sheep, moose, and bison by journeying on foot or by horseback into their distant retreats. In the fall and spring, when the crowds are absent, wild deer gather in great numbers at the hotel clearings to crop the grass, and the officers' children feed them flowers. One of the diversions at the road builders' camps in the wilderness is cultivating the acquaintance of the animals. There are photographs of men feeding sugar to bear cubs while the mother bear looks idly on.

"Thus one of the most interesting lessons from the Yellowstone is that wild animals are fearful and dangerous only when men treat them as game or as enemies. Even the big grizzlies, which are generally believed to be ferocious, are proved by our national parks experience to be entirely inoffensive if not attacked. Even when attacked they make every possible effort to escape, and only turn upon men when finally driven into some place from which they can not get away. Then only are they dangerous, and then they are dangerous indeed.

"This wild animal paradise contains thirty thousand elk, a thousand moose, innumerable deer, many antelope, and a large and increasing herd of bison.

"It is an excellent bird preserve also; more than a hundred and fifty species live natural, undisturbed lives. Eagles abound among the crags. Wild geese and ducks are found in profusion. Many large white pelicans add to the picturesqueness of Yellowstone Lake."

Concerning the Rocky Mountain National Park, the same report says: "This range was once a famous hunting ground for large game. Lord Dunraven, the English sportsman, visited it yearly to shoot its deer, bear, and bighorn sheep, and once he tried to buy it for a private game preserve. Now that the Government has made it a national park, the protection offered its wild animals will make it in a few years one of the most successful wild-animal refuges in the world."

OTHER GAME REFUGES

The national military parks have been created on a few of the battle fields to commemorate some of the more important engagements of the Civil War in Pennsylvania, Maryland, Georgia, Tennessee, and Mississippi. The total area of the five parks is 11,348 acres. They are under the jurisdiction of the War Department, and each of those at Gettysburg, Chickamauga, Shiloh, and Vicksburg is administrated by a special commission of three members which reports annually to the Secretary of War. Their importance as refuges is due to the fact that they furnish absolute protection at all seasons to small mammals and birds under a comprehensive law for the protection of wild life, enacted in 1897. Moreover, their location is such that, taking into consideration other military reservations, as the national cemeteries at Arlington and Fredericksburg, Va., and at other points, they practically form a chain of refuges for migratory land birds almost directly in the line of their northward flight.

In addition to the above, the Federal Government maintains several reservations, chiefly for big game. These comprise two national game preserves in Arizona and Oklahoma; the National Bison Range in Montana; the Mount Olympus National Monument in Washington; the Muir Woods and Pinnacles National Monuments in California; the Colorado National Monument; and the Mukuntuweap National Monument in Utah. The Department of Agriculture has jurisdiction over the two game preserves and the Mount Olympus National Monument, which are under the immediate charge of the Forest Service, and the Bison range which is in charge of the Biological Survey; and the Department of the Interior has jurisdiction over the other four national monuments. The wild life on the game preserves and the national monuments is protected by the acts under which these reservations were created; and the buffalo on the Bison Range and the elk on the Mount Olympus National Monument are protected throughout the year under the game laws of Montana and Washington.

The national game reservations and the Bison Range are the only reservations which have been stocked with big game. On the Wichita Preserve in Oklahoma and on the Bison Range in Montana are herds of buffalo donated, respectively, by the New York Zoological Society in 1907, and the American Bison Society in 1909. The Wichita preserve has also a few deer. The big game on the Grand Canyon preserve is limited to deer and mountain sheep, which are now fairly abundant.

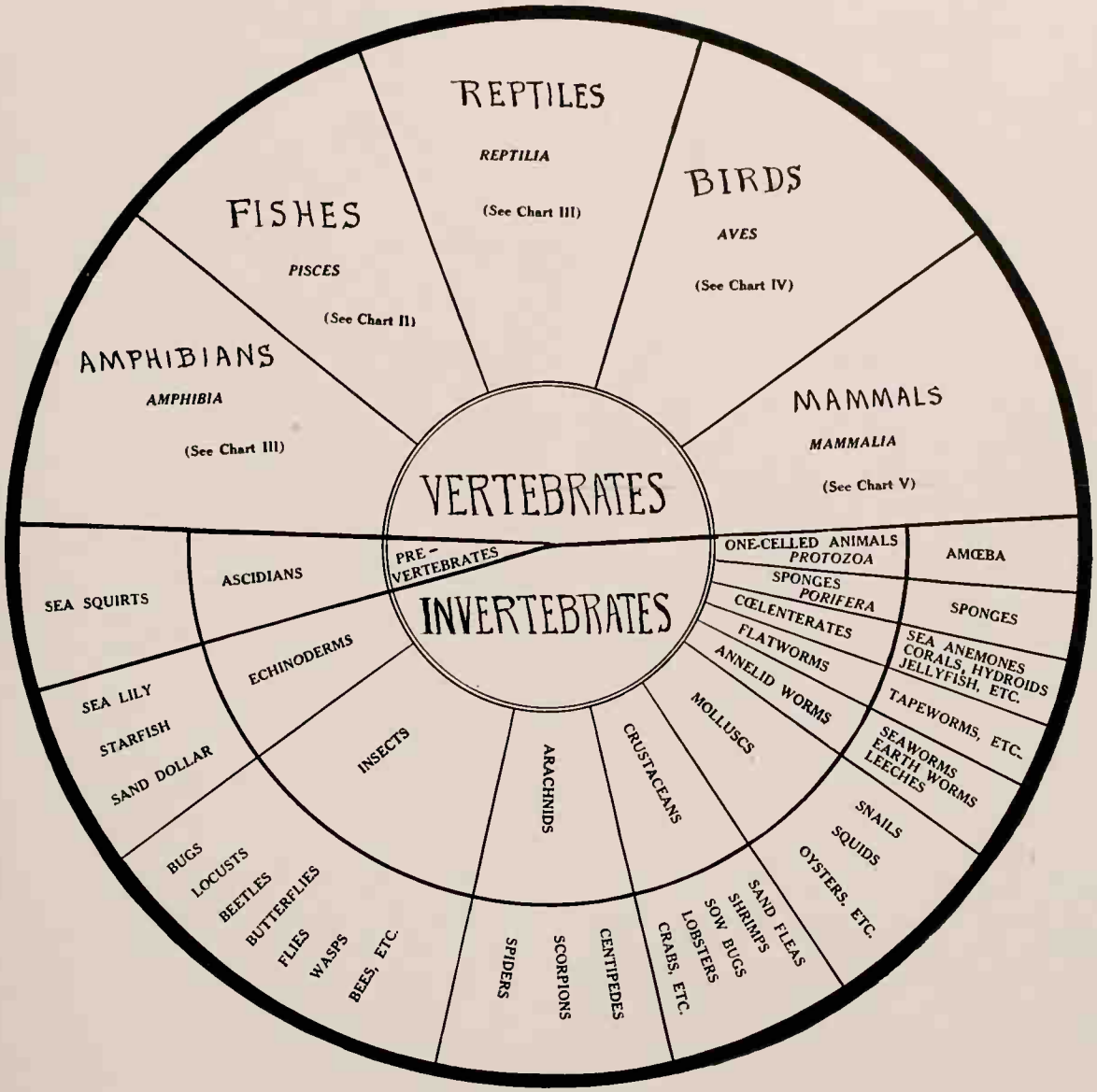
The Mount Olympus National Monument is the home of many deer and the summer range of the Roosevelt elk. Recent estimates indicate that the elk on the Olympic National Forest have increased to several thousand head. The Muir Woods, consisting of a grove of magnificent redwood trees in Marin County, California, shelter a few deer and also afford protection to small mammals and birds which here receive protection throughout the year. The Colorado and the Mukuntuweap National Monuments, comprising rugged canyons, give protection to various birds and small mammals.

Several national reservations have become game preserves through subsequent State legislation, which has made them wholly or in part State game preserves. With the exception of the Pinnacles Preserve in California, they are all in national forests, and as hunting is permitted in national forests, they are the only parts of the forests, except the few monuments and bird reserves and two game preserves, which actually form refuges. The largest is the Superior National Forest in Minnesota, which was made a State game preserve soon after the establishment of the national forest. In each case the game is protected primarily by State laws and the reservation patrolled and maintained by coöperation between the State and the General Government.

THE KING OF THE CERVIDAE

The Wapiti, or Elk, is one of the most fearless of fighters. His great size, and activity have crowned him King of the Deer tribe

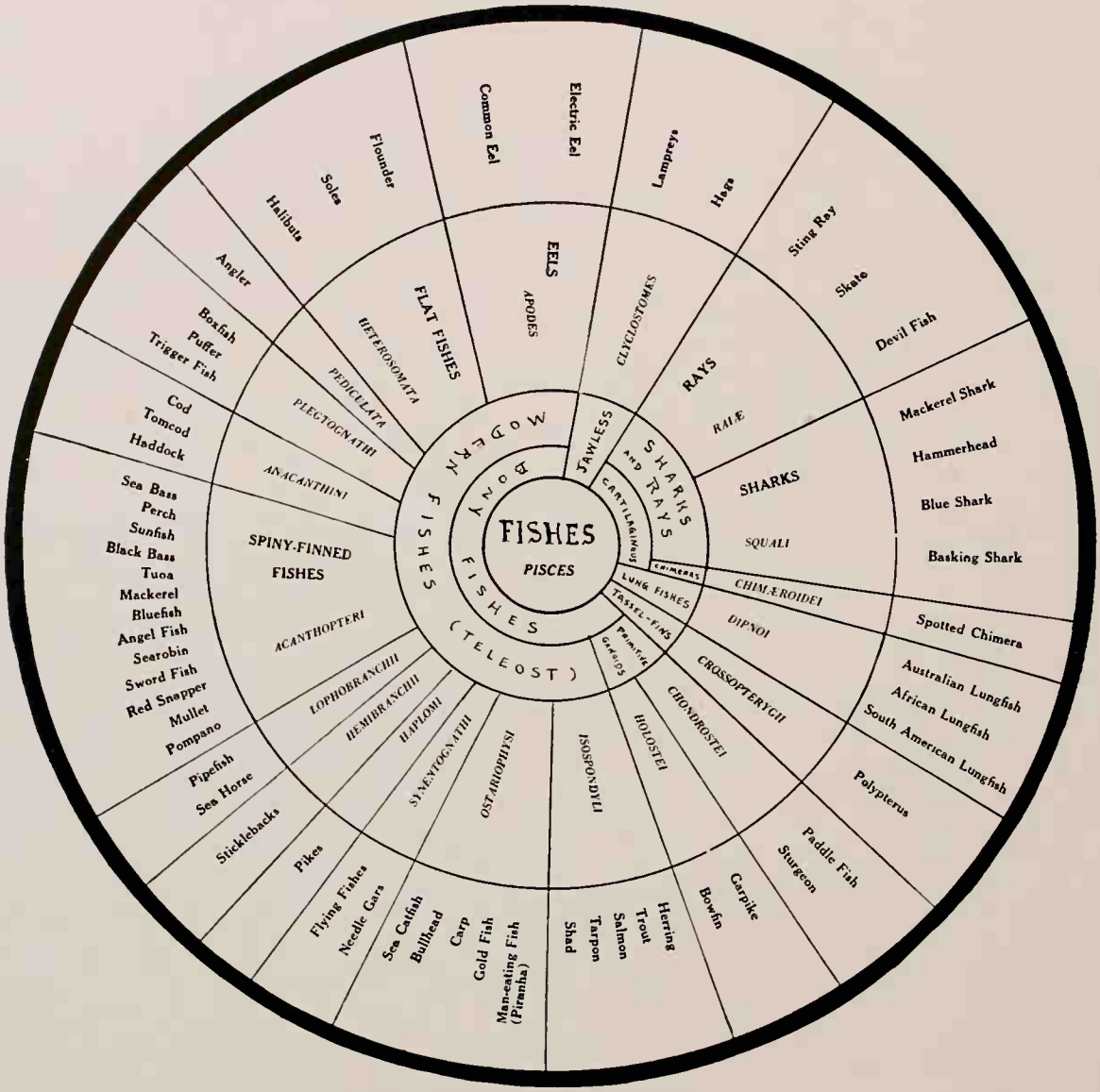
CHART I



VERTEBRATES AND INVERTEBRATES

The above may be regarded as a Key Chart to those which follow; but it is graphic and not evolutionary. While the entire Animal World is divided into two Kingdoms — the Invertebrates, or Spineless Animals, and the Vertebrates, or those having a spinal column,— the latter in the scheme of evolution are derived from or through the former. Also, for the sake of ease of reference, the main divisions of the Invertebrates are indicated above; while the Vertebrates are referred to other charts. The Pre-Vertebrates, as shown above, are an intermediate form between the two Kingdoms.

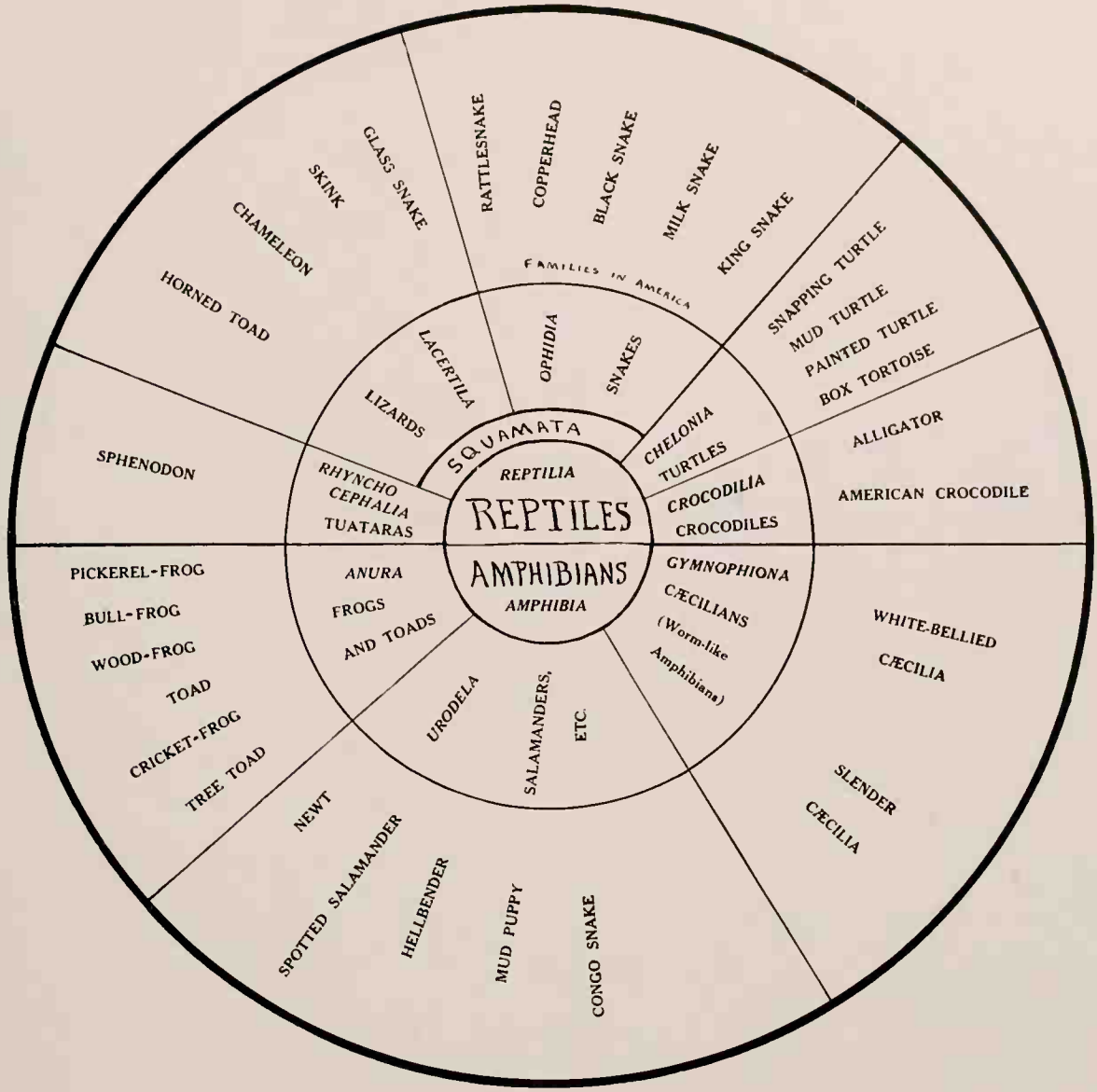
CHART II



FISHES

Fishes are among the oldest forms of Vertebrate life. Their fossil remains have been found in strata belonging to the upper part of the Silurian division of the Palæozoic epoch. They may be broadly described as cold-blooded Vertebrates, adapted to a strictly aquatic life, breathing by means of gills, and with external limbs modified into fins. In the above chart, emphasis in some orders has been placed upon forms familiar to American waters.

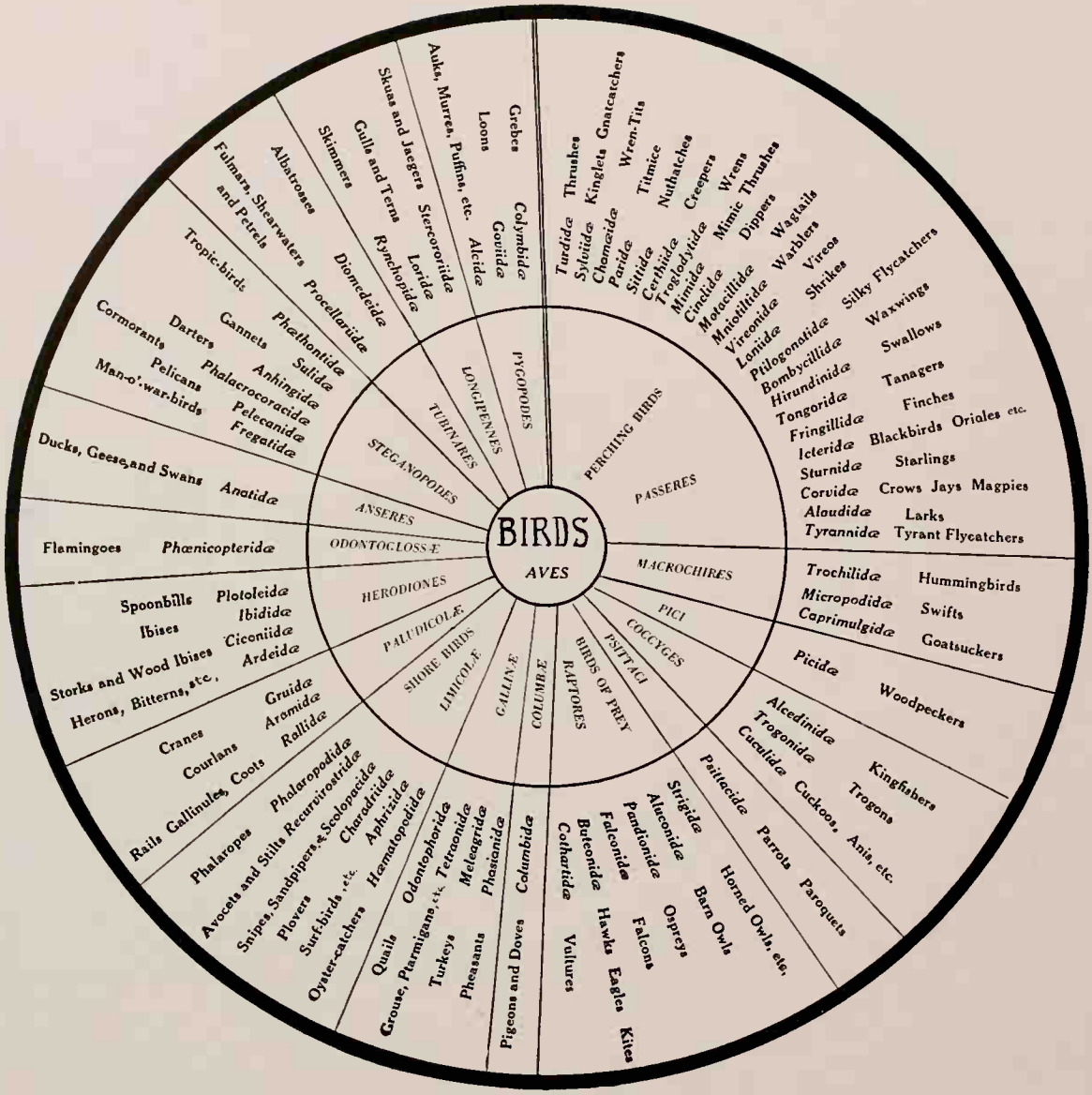
CHART III



REPTILES AND AMPHIBIANS

These two classes are often confused in the popular mind. The term, Reptile, has been applied indiscriminately to Crocodiles, Turtles, Snakes, Lizards, Tuataras, Frogs, Toads, Salamanders, and Cæcilians; whereas it belongs correctly to only the first five groups, the others being classified as Amphibians. There are important structural differences. The Reptiles on their higher level are the ancestors of the Birds. Their lower forms are closely related to the Amphibians, which, in turn, are intimately connected with the Fishes. There are intermediate forms, also, which make it difficult to distinguish boundaries sharply. A majority of the Amphibians undergo metamorphoses, or changes, before reaching their final form.

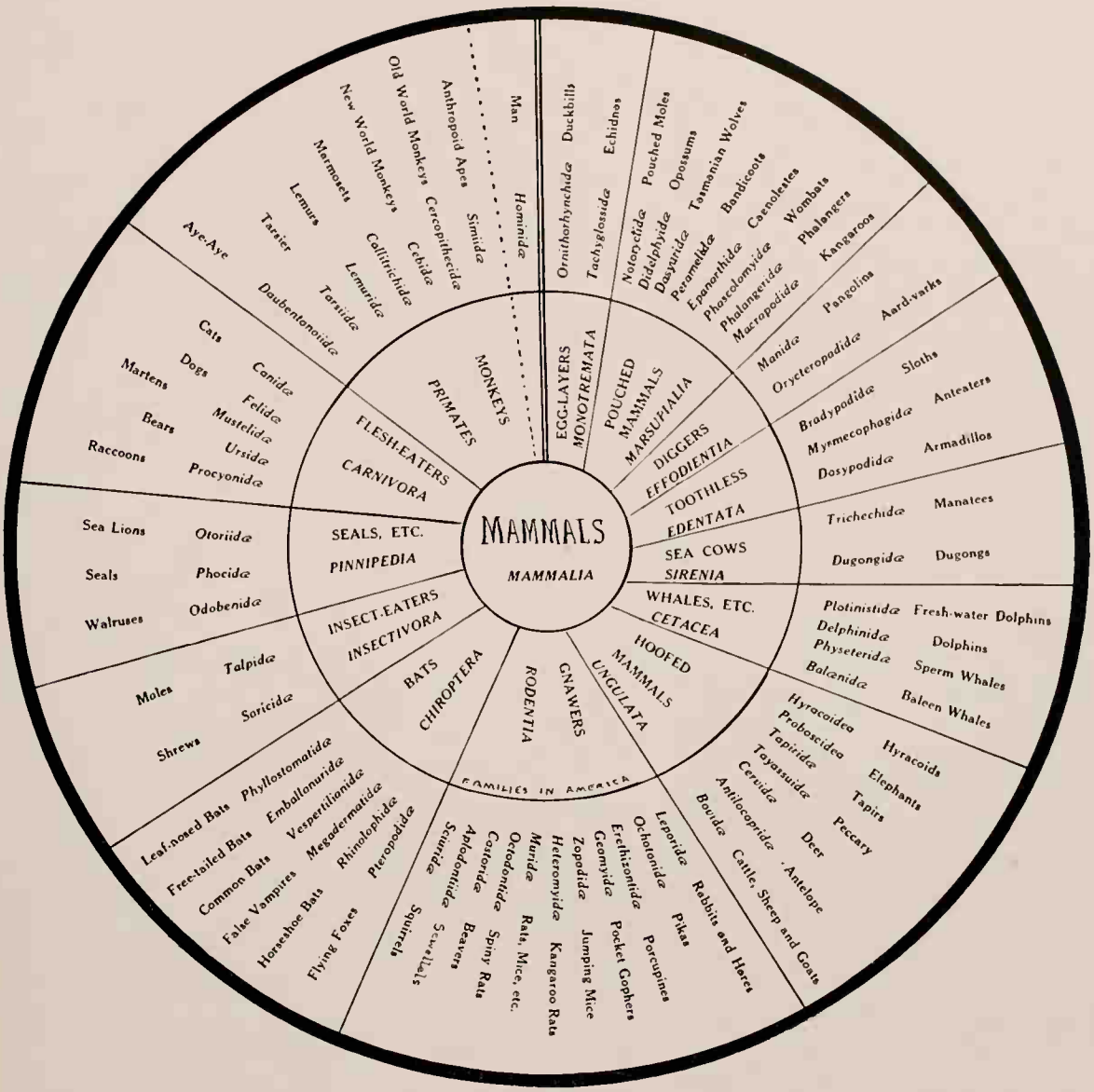
CHART IV



BIRDS OF AMERICA

The above chart is limited to a consideration of the Birds of America, only; the reason for this being twofold. The world at large contains hundreds of bird families, which could not be included in a chart of this size, with ease or profit to the student. Secondly, the above classification follows that officially adopted by the American Ornithologists' Union, showing seventeen orders, beginning with the lowest forms, the Diving Birds, and ending with the highest, the Perching Birds. The classification by certain foreign authorities shows a larger number of orders (usually 21) some of which overlap the American classification through sub-orders. The terminology, also, is different. It was thought best, therefore, to limit this chart to American orders and families, and to use only the names by which they are recognized in this country.

CHART V



MAMMALS

In the Mammals we reach the highest forms of animal life, the final order including Man himself. The lowest forms include the Monotremes, or Egg-Laying Mammals, and the Marsupials, or Pouched Mammals. The gradual ascent upward is shown on the above chart, reading from right to left. Mammals differ from other animals in the following characters: the possession of hair, mammary glands or breasts, a high blood temperature, a four-chambered heart, a diaphragm, and a highly developed nervous system. In the above chart a general world survey is made, except that, under Rodents, only the American families could be included, because of the very large number of these little Gnawers all over the world.

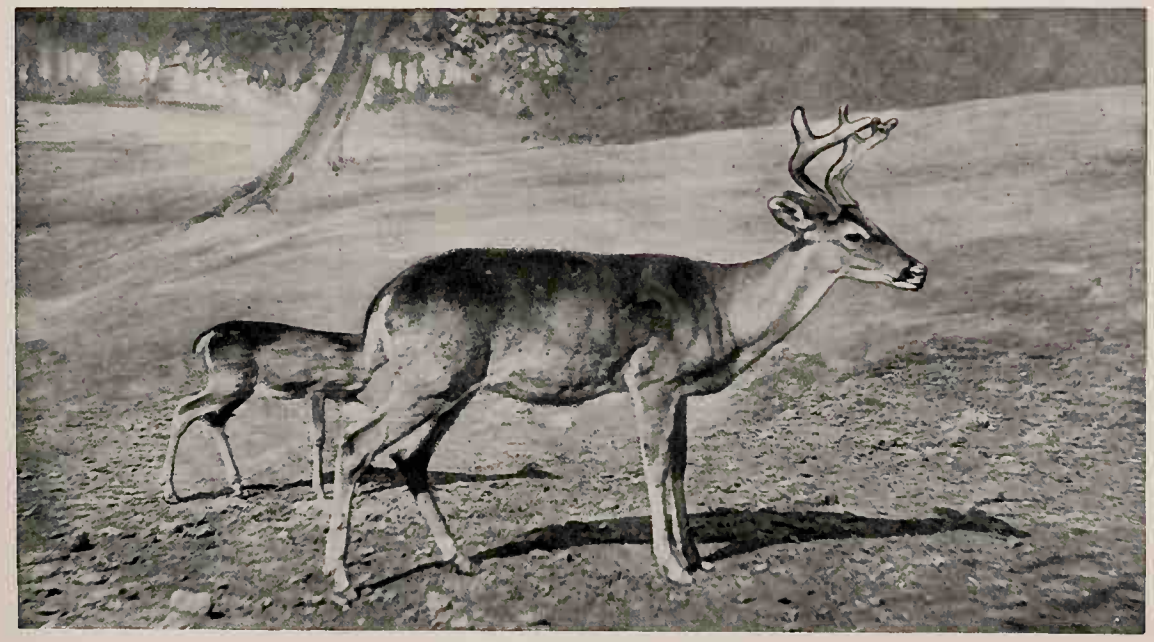
ORDER OF HOOFED ANIMALS

(Ungulata)

THIS order is one of the most important among animals. It includes some of the largest mammals both in this country and abroad. The order is called "Ungulata" from a Latin word meaning "hoofed." In this order are to be found the deer, pigs, sheep, oxen, horses, elephants, etc. The Ungulates are nearly all animals of good size and some of them are the largest of living land mammals. They are thus characterized: the toes or digits end in hoofs, and the animal walks upon the toes or is digitigrade; they lack the clavicle or so called "collar bone"; a full set of milk teeth always precedes the permanent teeth; the molar teeth have ridged or tuberculated grinding surfaces.

This order is commonly split up into two sub-orders as follows; the odd-toed Ungulates or *Perissodactyla*, such as the Horse and the Tapir, and the even-toed Ungulates or *Artiodactyla*, to which all the North American mammals of recent times belong.

The *Artiodactyla* is a very large group, and besides containing all the North American Ungulates, claims as well nearly all those of the Old World, and the host of African Antelopes.



VIRGINIA DEER AND FAWN

These beautiful animals are easily domesticated, and their breeding might become a profitable industry

Animals of this sub-order have the first toe wanting, the second and fifth toes small, rudimentary or absent, and carry the weight upon the third and fourth toes. Animals of this type generally have extremely long feet and legs, and for this reason are fleet and graceful runners.

The hoofed animals are herbivorous — that is they eat herbs and vegetation. In the Deer, Oxen and Sheep families they are also ruminants, or cud-chewing. The ruminants have a four-compartment stomach, regurgitate or bring up their food, and chew the

cud. As a rule they lack the upper canine teeth. All of the North American Artiodactyls have frontal appendages in the shape of horns or antlers, if not found in both sexes, at least to be found on the male. The order is well represented on all the continents of the globe, with the exception of Australia, but at the present day it has a far larger number of species in the Old World than in the New; many of these from the former area belonging to groups quite unknown in the latter. Although represented in the Arctic regions only by the Reindeer and the Musk-ox, Ungulates are found alike in the coldest and the hottest regions of the globe. The maximum number of peculiar forms, as well as those of greatest size are, however, inhabitants of the tropical and subtropical regions; and it is also in the warmer regions that the greatest number of species occur. As regards the number of individuals of peculiar species, many Ungulates far exceed any other of the larger mammals; this being the case with the Bison, which but a few years ago roamed in countless thousands over the prairies of North America, and with the myriad hosts of Springboks in the South African veldt. Not only are the Ungulates widely distributed in longitude and latitude, but they are also found at all elevations suitable for the existence of animal life; some of the wild Sheep of the Himalaya ranging to elevations of fully twenty thousand feet above the level of the sea. In time the order is an ancient one, being represented in the earliest stages of the Eocene division of the Tertiary period, although the species were mostly small, and in all cases widely different from any now living.

The following diagram shows the division into families and species, in this country:

ORDER OF HOOFED ANIMALS (UNGULATA)

FAMILIES

(In North America)

Peccaries (*Tayassuidæ*)	**Deer** (*Cervidæ*)	**Antelope** (*Antilocapridæ*)	**Oxen and Sheep** (*Bovidæ*)
(Only species)	(Typical species)	(Only species)	(Typical species)
Collared Peccary	**Wapiti, or Elk**	**Pronghorn Antelope**	**Bison, or Buffalo**
	White-tailed Deer		**Musk-Ox**
	Black-tailed Deer		**Rocky Mountain Sheep**
	Mule Deer		**Rocky Mountain Goat**
	Moose		
	Woodland Caribou		
	Barren-ground Caribou		
	Reindeer		

THE DEER FAMILY

(*Cervidæ*)

THE Deer family stands next to the Cattle and Sheep family (*Bovidæ*) in general utility. The flesh is a valuable food, while the antlers or horns, as well as the skins, are important articles of commerce. Venison was more common than beef on the tables of medieval Europe, and was the flesh most commonly eaten by early settlers and frontiersmen in North America. Its dietetic value is enhanced by the fact that it is especially adapted to invalids who require a nourishing yet easily digested food.

Except in a few species like the Caribou, adult male Deer have antlers. Although these horns are deciduous, they are solid processes produced from the frontal bone, and have the physical as well as the chemical properties of true bone. They are of two general types — those more or less broad and flat, and those rounded in shape. Those of the flattened type are usually the more massive, but the rounded antlers of the Wapiti are exceptionally heavy.

Deerhorn has several uses. It produces much gelatin by decoction, the product being like that from most animal substances. The raspings and waste pieces of the horns used in manufacturing knife handles are either made into gelatin or boiled down into size used in cloth manufacture. At one time deerhorn was a prominent source of ammonia.

The principal use of deerhorn is in the manufacturing of handles for knives, forks, and other instruments. In Sheffield, England, some thirty years ago, about 500 tons of deerhorn were used annually in manufacture. India and Ceylon furnished about four-fifths of this material, while about 100 tons came from European and English deer forests. The 500 tons represented the antlers of fully 350,000 Deer of various species. In Europe buckhorn is worked up into many useful articles, as umbrella stands, chandeliers, and ornaments for personal wear.

The use of deerskins is well known. As tanned and dressed by the American Indians they are manufactured into a variety of useful and ornamental articles. The inhabitants of some of the Indian villages of the North derive a good income from their manufactures of deerskins into moccasins, rackets, toboggans, and other things for sale. Deer hide makes an excellent leather, its value depending upon the size as well as upon the species from which it comes. The skins of Wapiti, for instance, are porous, and the leather does not wear well, while those of the Moose and European Elk are so thick and hard that the leather is said to have resisted musket balls. In Sweden in former times a pair of elk-hide breeches went as a legacy through several generations of peasants. Formerly about 200,000 deerskins from North America were sold annually in the London market. Half of these were skins of the Wapiti. Many were bought for Germany and there manufactured into leggings, but the heavier skins were tanned and manufactured in England. In recent years the export of deerskins from America has fallen off greatly.

Deer hair has a peculiar cellular structure, and is used in some parts of the world for stuffing saddles, for which purpose it is especially suited.

North America is comparatively rich in species of Deer. All of them are valuable food animals, and nearly all have been of great commercial and economic value during the development of the country. While their commercial importance has been greatly lessened as their numbers diminished, they still play an important part in furnishing food in newly settled parts of the United States and Canada, as well as in feeding the native tribes in the far North. Except in States that have extensive forested areas and have protected deer for a series of years, they are rapidly disappearing before the encroachments of agriculture. The remnant are valuable chiefly because they are a natural resource which may be indefinitely developed if carefully husbanded. DAVID E. LANTZ, U. S. Biological Survey.

WAPITI, OR AMERICAN ELK

Cervus canadensis (*Erxleben*)

General Description.— A large member of the deer family, the male with massive antlers shed annually, the female hornless and smaller. Weight of adult bull, 600 pounds or more. Color, yellowish-gray to tawny-brown. Tail short. A fine, well-proportioned animal standing about five feet at the shoulders. Gregarious in habit.

Dental Formula.— Incisors, $\frac{0-0}{4-4}$; Canines, $\frac{1-1}{0-0}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3} = 34$.

Pelage.— ADULTS. Sexes essentially similar in coloration, but female generally with the dark colored parts paler than in the male. General body color tawny-brown varying with the individual. Head, neck, chest and under parts darker brown to nearly black; legs clove-brown. A large conspicuous straw-colored patch on rump, surrounding tail. Hairs on neck long and forming a shaggy mane. Hairs everywhere rather long and coarse. YOUNG. Tawny spotted with white until the first fall, when pelage resembling that of the adults is assumed.

Measurements.— Total length 8 feet for male, 7 feet for female. Tail 8 inches. Height at shoulder 5 feet. Weight, male, 600 to 700 pounds. Horns of a record bull 64 and 66 inches along the beam.

Range.— Formerly from the Atlantic Ocean to the Rocky Mountains. Now limited generally to western Canada, Montana, Wyoming, Colorado, and the Pacific Coast.

Food.— A variety of grasses, leaves and buds.

Remarks.— The American Elk is not to be confused with the Elk of the Old World, an animal more nearly related to the North American Moose. With the exception of the Moose, the Wapiti is the largest of the American deer family. All of the different varieties of Wapiti are variations of the same general color pattern and contour.

RELATED SPECIES

American Elk, or Wapiti.— *Cervus canadensis canadensis* (Erxleben). The typical form just described. Eastern North America to the Rockies, but today extinct over eastern portion of this range.

Western Wapiti.— *Cervus canadensis occidentalis* (Ham. Smith). Darker in coloration. Extreme western North America.

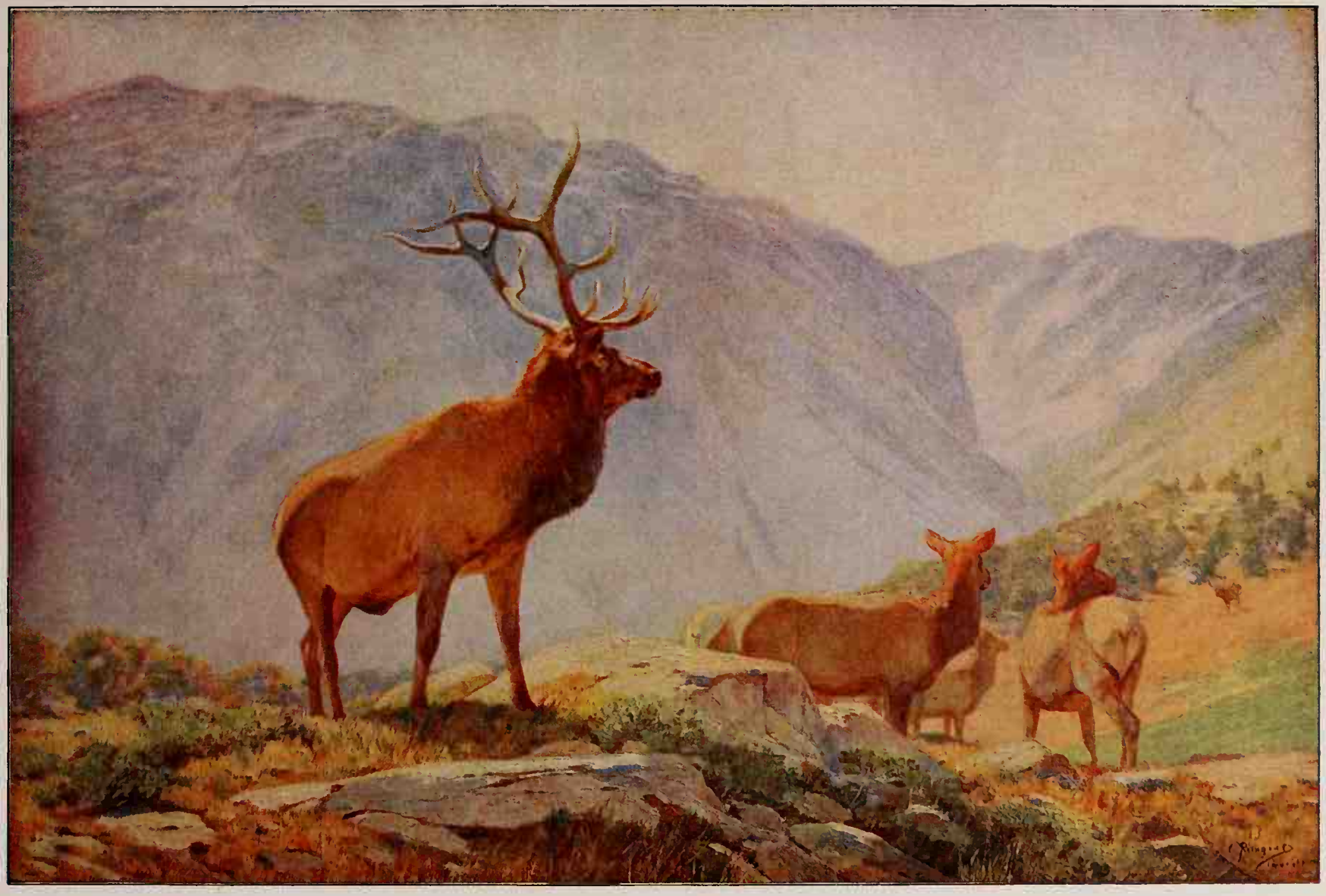
Merriam Elk.— *Cervus merriami* Nelson. Nose darker, head and legs redder than *canadensis*. Mountains of western New Mexico and eastern Arizona. Probably extinct.

California Wapiti.— *Cervus nannodes* (Merriam). Smallest of the Elk; pale. Known only in California, and nearing extinction.

By permission of the New York Zoological Society

WAPITI, OR ELK

The American "Elk" is, next to the Moose, the largest of the Deer family, and is easily the handsomest. It has superb widely branching antlers



From a painting Copyrighted by Carl Rungius

THE CHALLENGE

A bull Elk has heard the defiant call of an interloper in the valley below, and stands ready to defend his "harem."

" Monarch of the glen, lord of the wilderness, king of the red deer tribe is the Wapiti," says Singer. " The antlers are the most magnificent trophies yielded by any of our American game animals, save the single possible exception of the giant Alaskan moose. Even so, the length of horn of the Wapiti with its wide, graceful sweep, long tines, massiveness, and symmetry is more admired and desired by many than the huge, heavy, grotesque antlers of the moose."

Naturalists and sportsmen agree in designating the Wapiti or " Elk " as the handsomest of the deer kind. "A creature of regal presence," " the lordliest animal on earth," are among the descriptions of it one finds in the diaries of hunters and in works on natural history; Colonel Theodore Roosevelt considers it to be " the grandest of the deer kind throughout the world " and its antlers as " marvels of symmetrical grandeur."

"A full-grown Wapiti is normally of twelve tines," says Singer. " The cows grow no antlers, differing in this respect from the caribou cows which grow small pointed antlers. It would not be amiss at this point to call attention to the difference between horns and antlers. A horn is a hollow sheath growing over a bony substance, and except in the case of the antelope, it is never shed. Horns are worn by both sexes of all bison, buffaloes, antelopes, sheep, goats and cattle. An antler is a solid bone throughout, growing from the skull, and is shed every year close to the skull, and quickly regrown. They are worn by nearly all male members of the deer family — moose, wapiti, caribou, deer, etc."

The Wapiti is one of the round-horned deer. For an animal of its size and weight, its legs are comparatively slender. It carries its head high, and has a luxuriant mane. The general body color is a pale tawny brown; the head, neck, and chest are dark brown; and there is a large yellowish white patch on the rump. The coat is shed between May and the middle of September.

A native of North America, the history of the Wapiti is a repetition of that of the Bison — persistent and ruthless slaughter by man. In former times it was found over most of the North American continent, from Mexico to Vancouver, and from New Jersey across the Alleghenies to the Pacific coast. It lived, like the Buffalo, on the open plains. In 1849 in the great valley of San Joaquin, in California, bands of Wapiti numbering many thousands roamed like cattle. Today it is confined chiefly to the northern region of the Rocky Mountains, but nowhere can it be said to be abundant except in the Yellowstone National Park, where perhaps there are some 30,000. Small herds and scattered individuals are occasionally met with in various States, and Wapiti from private parks and preserves have from time to time been liberated in various forests, as by Mr W. C. Whitney in the Adirondacks, in the Saranac Lake region, and elsewhere. It is gratifying to note that the number of States in which this lordly animal receives protection is increasing.

The King of the Cervidæ, for as such is the Wapiti looked upon, differs from his lesser kin, the Mule Deer, in that he is more gregarious and highly polygamous. Another point of difference is that he is not given to feeding at night, but at the first indication of day and in the late afternoon. During the day they lie down usually on an open, sunny hillslope facing the south, or in the timber if much hunted. In winter when the snow is deep they are naturally more inclined to browsing, even standing on their hind legs to enable them to reach higher up in the trees. They are especially fond of aspen, birch and the tops of the willows. In winter they gather in large bands and keep the snow well trodden down in the locality which they have selected.

The shedding of the antlers of the full grown stag usually takes place late in December or during the month of January. The spike-horn bulls do not shed until much later, often as late as May or June. They are proud of their little sharp antlers, and do not hesitate to remind with a prod the old bulls who have shed, that they are still well armed. The new antlers begin to sprout in March or April, and during the summer while growing they are covered with hair, and are soft and full of blood, with club-like knobs. In this condition they are spoken of as being " in the velvet." It is a great drain on their system while this remarkable growth is going on. The stags grow thin and the fear of hurting their young antlers, which are very tender, makes them quite timid and inoffensive. By the middle of August the antlers are completely grown and the covering or velvet is then rubbed off against trees and bushes, and the ends of the tines polished. For many are the battles to be fought before gaining full possession of a harem.

The mating season varies in different localities, but usually begins in September. At this time the bulls become very pugnacious; their necks swell; and they challenge continually. The call, or " bugle," of the male Wapiti is described by

Dr. Hornaday as "a shrill shriek, like an English locomotive whistle, sliding down the scale into a terrific bawl"; but Colonel Roosevelt considers that, "heard at a little distance, and in its proper place, it is one of the grandest and most beautiful sounds in nature." The fawns, usually one or two, but occasionally three, are born in May or June and sometimes as late as August. Their coats are spotted, but the spots disappear in twelve or thirteen weeks.

Except in late spring and summer, Wapiti are restless, roving animals. Their migrations vary in different places both in regard to distance and to time. In the old times, before they had been molested by man, herds were known to travel as far as 200 miles. The Wapiti in the Yellowstone National park migrate south every winter to Jackson's Hole.

Photograph by H. N. Stabeck

ELK AT HOME

The Elk enjoys a timbered country such as this, where it may obtain both protection and food

The Wapiti has been described as "the most omnivorous of the vegetarians." It both browses and grazes, eating grasses, leaves, and especially the buds and tender shoots of deciduous shrubs. It is fond of the water, and is equally at home among the high mountains, in the deep forests, and on treeless plains.

The economic value of the Wapiti as a food animal has not hitherto been sufficiently appreciated. It is easily domesticated, becoming in three or four generations "as gentle as sheep that run wild." It is less nervous and more easily confined than the ordinary deer. Given suitable State regulations for killing and marketing, elk venison could be raised more cheaply than beef, mutton, or pork. A cow Wapiti yields a considerably larger percentage of dressed meat than cattle. But the existing regulations are prohibitive of successful elk-raising. In some States the railway companies are precluded from carrying venison at all except in the open season; and persons who keep deer in confinement are subject to a tax, and if they wish to kill one of their own animals have to pay a fee before the State accords the privilege of slaughtering. The foregoing opinions are those generally held by men who have raised Wapiti successfully, so far as increase of the herds is concerned; and as the venison is admitted by scientific experts to form a highly nourishing article of diet, it is to be hoped further legislation may result in the establishment of a new and useful industry.

The Wapiti has often been trained to run in harness, and "trotting elks" have frequently been a feature of county fairs. Some years ago Mr. W. H. Barnes, of Sioux City, "drove a pair of Wapiti to a light wagon, and trained one to dive into a pool of water thirty feet below."

The natural gait of Wapiti is a walk. They trot with a long, graceful stride, and seldom break into a gallop unless much alarmed; but they cannot sustain the latter gait for any great length of time.

"Wapiti are extremely graceful creatures; their every move is the poetry of motion," says Singer. "I call to mind an especially beautiful scene. On the brow of a hill, silhouetted against the sky in the early dawn, fed a large band of Wapiti. First came the cows and calves, with their long, slender legs, small, well-formed heads, big ears and coats that glistened like satin in the early light. At the rear strode the ruler of the band, a fine, lordly stag. What a splendid picture they made, sharply defined against the tinted sky!"

The same sportsman gives the following vivid picture of a battle royal between two bull elk: "Up the mountain he came, the second stag who elected to do battle. Defiant and mad all through stood the big fellow up the slope, under the big spruce. But now, as his wrath grew with each approaching step of the bold intruder, he at last broke his wonderful pose, stamped his hoof in furious rage, and roared a threatening challenge to his foe. What the intruding stag lacked in stature he seemed to more than make up in courage, for he showed no intention of being turned aside by anything less than a battle ending in his defeat.

"What looked to be twenty feet was all that now intervened between the two great lords of the wilderness. Then, as if by silent command, the battle was on. With heads lowered between

their forefeet the two adversaries walked around, waiting for an opening. Suddenly there was a savage rush, and as they met their antlers came together with such terrific force that their forefeet were raised from the ground. Slowly retreating, bellowing and threatening in a paroxysm of rage, they again circled around. Then came lowing he sullenly moved off, turned down the mountain and passed into the shadows of the gathering gloom."

Mr. George Bird Grinnell has also given us an excellent pen picture of an elk herd: "From a distant ravine comes the shrill, sweet whistle of a great bull elk as he utters his bold

Photograph by W. Rau

WAPITI

The distinctive dark coloration of the head, neck, and chest are here well displayed

another charge, even more savage than the first. The intruder, or challenging bull, seemed to be doing most of the offensive fighting.

"At length he appeared to be weakening. Once when they came together he went to his knees. Finally he backed off; it was plain that the daring young bull had been worsted. Still ugly and belchallenge to all rivals far and near. You can see him plainly as he walks out from the timber and slowly climbs the hill, followed by the group of watchful cows; and he is a splendid picture. Short-bodied, strong-limbed, round and sleek-coated, he is a marvel of strength if not of grace. His yellow body is in sharp contrast with the

dark brown head and mane, and the hugely branching antlers, wide spread and reaching far back over his shoulders, seem almost too much for him to carry; so that as he marches along with ponderous tread each step seems to shake the earth. At intervals he throws back his head and utters a wild call, and before its first notes reach the ear you can see the white steam of his breath as it pours forth into the frosty air. His cows feed near to him as he steps along, or if one straggles too far, he moves slowly toward her, and shaking his mighty horns warns her to return. If you fire a shot at one of that band, speedily the old bull will show himself the herder and protector of his family. Rushing about from point to point he will gather up cows and calves into a close bunch and will drive them off over the hills, threatening the laggards with his horns and using them too with cruel effect if the cows do not hurry. No chivalry this on the part of the old bull — he drives them forward not because he wishes to protect them from death, but because the cows are his, and he does not intend to be robbed of his wives and children."

Among the lesser known species of this animal are: the *Western Wapiti*, which is found in the Far West, and differs from the accepted type by being darker in color; and the *California Wapiti*, a very rare animal which is much smaller and paler in color. The *Merriam Elk* of New Mexico and Arizona is also a varying type that has become extremely rare.

VIRGINIA DEER

Odocoileus americanus (*Erxleben*)

Other Name.— White-tailed Deer.

General Description.— A fairly large Deer, the male with deciduous antlers, female lacking antlers. Tail long for a Deer, rather bushy and conspicuously white on the underside. Antlers moderately large and branching, directed forward, no brow tines. Color reddish-brown.

Dental Formula.—Incisors, $\frac{0-0}{3-3}$ Canines, $\frac{0-0}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3} = 32$.

Pelage.— Adults: Color of sexes similar. *Summer.* Body color reddish-brown, with belly, underside and tip of tail, inside of legs, and throat patch white. Band across nose and ring about eye whitish. Spot on each side of nose blackish. Upper surface of tail dusky. *Winter.* Body color grayish to grayish-brown. Hair long and somewhat brittle in character. Young: Reddish-brown or rufous with white spotting, the spots persisting until the fourth or fifth month.

Measurements.— Length, male, 5 to 5½ feet. Tail 12 inches. Height at shoulder 3 feet. Female somewhat smaller. Weight, male, 225 to 300 pounds.

Range.— From Atlantic seaboard to the Great Plains and from the Gulf to about 43° north.

Food.— Grasses, leaves of shrubs and trees, mast and aquatic plants.

Remarks.— The best known of the American Deer. A number of varieties have been described which differ from the above mainly in minor details.

Related Species

Virginia Deer, or White-tailed Deer.— *Odocoileus americanus americanus* (Erxleben). The typical animal. The middle and eastern United States and Canada.

Northern Virginia Deer.— *Odocoileus americanus borealis* Miller. Larger and grayer. Northern part of United States and southern Canada west to Rockies.

Louisiana White-tailed Deer.— *Odocoileus americanus louisianæ* (G. M. Allen). Pale and with slender skull. Louisiana and Gulf States.

Plains White-tailed Deer.— *Odocoileus americanus macrourus* (Rafinesque). Pale than the typical form. Upper Mississippi Valley.

Texas White-tailed Deer.— *Odocoileus texanus* (Mearns). Size small, color pale, legs short. Rio Grande region of Texas.

Florida White-tailed Deer.— *Odocoileus osceola* (Bangs). Size of Texas Deer, but much darker. Florida.

Sonora White-tailed Deer.— *Odocoileus couesi* (Coues and Yarrow). Paler and smaller than typical *americanus*. Weight of adult buck about 80 pounds.

Douglas White-tailed Deer, or Oregon White-tailed Deer.— *Odocoileus leucurus* (Douglas). Lacks black markings; has more white. Oregon.

The Virginia, or White-tailed Deer, commonly known among sportsmen as the "White-tail," is the most widely distributed game animal of the United States; it was the first kind of Deer killed for food by the early settlers on the Atlantic coast; and the prophecy has been made that "it will also be the last of the large hoofed animals of North America to become extinct." Related species range from Canada and New England, as far south as Texas. Thanks to the

Photo copyright by D. D. Sherman

A WHITE-TAIL BUCK SURPRISED

Photographed at night by means of a jack-light at Connecticut Lakes, New Hampshire

protection afforded by State game laws, the Virginia Deer is probably more numerous in New England and in New York State than it was thirty years ago. Its prolonged existence in a wild state has been accounted for by some mainly by "the fact that it is an inveterate skulker, and fond of the thickest cover. Accordingly it usually has to be killed by stealth and stratagem."

A fairly large White-tail measures five feet in length, and three feet high at the shoulders, and weighs a little over 280 pounds. The antlers differ from those of most other Deer in pointing forward as they rise, a short distance from the forehead. They rarely exceed twenty-nine inches in length.

Photograph by R. R. Raymond, U. S. A.

WHITE-TAIL FAWN

The fawns of the White-Tail Deer are particularly beautiful animals, and may be readily tamed. This was a wild one "snapped" in the open with a small folding camera

As might have been expected, the great differences in climate and habitat induce many changes of habits. For instance, in the North the mating season is October or November, and the fawns are born in May or June. In Louisiana the season begins in June or July, and the fawns are born in January or February. Each doe has usually but one fawn each year; it is fifteen and one-half inches high, and its weight is about four and one-half pounds. Again, in the Louisiana marshes the White-tail live in the same locality throughout the year; but in the Adirondacks the Deer change their habits with the seasons. "Soon after the fawns are born they come down to the water's edge, preferring the neighborhood of the lakes, but also haunting the stream banks. The next three months, during the hot weather, they keep very close to the water. Where they are much hunted, they only come to the water's edge after dark, but in regions where they are little disturbed they are quite as often diurnal in their habits. . . Before September the Deer cease coming to the water, and go back among the dense forests, and on the mountains. There is no genuine migration, as in the case of the mule-deer, from one big tract to another, and no entire desertion of any locality."

With the exception of the Adirondacks, Maine has the greatest number of Virginia Deer today, and this notwithstanding the fact that several

thousand are killed annually by hunters holding the permits of the State.

The White-tail is exceedingly graceful when in motion. One enthusiastic sportsman writes of it: "The White-tail moves with an indescribable spring and buoyancy. If surprised close up, and much terrified, it simply runs away as hard as it can, at a gait not materially different from that of any other game animal under like circumstances. . . But normally its mode of progression, whether it trots or gallops, is entirely unique. In trotting, the head and tail are both held erect, and the animal throws out its legs with a singularly proud and free motion. . . In the canter or gallop, the head and tail are also held erect, the flashing white brush being very conspicuous. Three or four low, long, marvellously springy bounds are taken, and then a great leap is made high in the air, which is succeeded by three or four low bounds, and then by another high leap. A White-tail going through the brush in this manner is a singularly beautiful sight."

No animal does better in captivity than the Virginia Deer. It feeds on almost any kind of vegetable. Lichens, mosses, fallen leaves, lily pads, acorns, beechnuts, chestnuts, and other mast, all go to make up its dietary. Add to these a good supply of running water and access to rocksalt, and the White-tail menu is complete. Except the goat, no animal requires so little attention. It is a prolific breeder. One buck is assigned to twelve does. The does begin breeding at seventeen months.

There are several related species of this Deer, but the slight differences in size or marking can usually be traced to environment. Commenting on this fact, Mr. Archibald Rutledge says (in *Field and Stream*):

YOUNG WHITE-TAIL DRINKING

Interesting snapshot of a young White-Tail, taken after dark with the aid of a flash-light

"The Virginia, or White-tail Deer is of very wide distribution in America, and it is perhaps better known and loved than any of our game animals. Yet, since, as is the case with all wild creatures, its environment has considerable to do with the nature and habits of the White-tail, those who know it best in one locality are unfamiliar with its manner of life in another. The White-tail of the Florida Everglades is, in many ways, very different from the Deer of the Adirondacks and those of the big Allegheny mountains. . . . For many years I have been acquainted with the White-tailed Deer as it is found in the South,

particularly in the great pine barrens and tupelo swamps of the Carolinas. There are few essential differences or peculiarities of the Deer of the South. As a rule they are smaller, sleeker creatures than those of the North, more graceful, too, and their coloring is lighter. It is very seldom, indeed, that a buck in the Carolinas will run 175 pounds. On the other hand, the antlers of the southern Deer are superior in beauty and symmetry, to, for instance, those of the Deer of

Photograph by C. E. Salter

TEXAS WHITE-TAIL FAWN

The fawns of the White-Tail group are beautifully spotted

the western Pennsylvania mountains. Recently, on a visit to a taxidermist's shop in that State, I examined the heads of twenty-six bucks, and but one pair of horns could be called fine in their size and symmetry. The others were bent, crooked, knotted and generally misshapen. The same condition was true at another time when I examined the antlers of nineteen bucks. However, a perfect Deer head of the North is a more splendid trophy than one of the South, the antlers have a larger beam, longer tines, and a wider spread. Their whole appearance is more picturesque and rugged. I take this difference in horns to be largely due to the fact that northern Deer are, for the most part, creatures of the mountains or of rough country. Their paths are up and down hill, along steep declivities, and through dense areas of second-growth sprouts. Of necessity, their horns get rough treatment; and when they are in the velvet, a rap or a push or a pull will mean, later in the hardened antler, some decided blemish. In the level, open woods of the South, it is only by singular mischance they are found with parts broken clear off, probably in a clash between rival bucks, but as a rule their development is normal and very graceful.

"I believe the Deer of the South are more gregarious than those of the other localities. When unmolested, they herd readily. Of course, in the mating season, extending through the autumn and the early winter, a buck will nearly always be found with two or three does. On four or five occasions I have seen a buck at that season with four does. But this gathering is not gregarious. At other times, in the great pine woods and swamps of the South, Deer are found in large families, and even where they are hunted a good deal, they are fond of running together. I have seen as many as eleven in such a drove, while a herd of six or eight is no uncommon sight. However, during the autumn and winter, deer of widely different ages do not consort; it is unusual at that season to see a fawn of the same year; certainly they do not associate with the bucks and does which are then mating. During a two days' hunt I have seen twenty or more Deer, everyone of which appeared large. The growing fawns are evidently dissociated from the older Deer during this season.

"If permitted to live out their lives, Deer will probably go from twelve to fifteen years. But one seldom sees a Deer as old as that. There is a scourge called the Black Tongue which comes through the southern woods periodically — generally every six or seven years. This dread disease pitifully depletes the ranks of the White-tail. Its symptoms are those of a galloping consumption, and I have no doubt that is a form of virulent tuberculosis; fever, ague, inertia, and general wasting away are some of its fatal signs. Negro turpentine workers have often told me of coming on Deer thus stricken; at which times they made no effort to clear themselves. I myself have never seen a Deer sick in this way, but I have ridden the woods after the plague had passed, and I have seen many that had perished by reason of it. Of course, there is no practical way of ministering to creatures so wild and shy, even if their disease were amenable to the skill of medi-

cine, because for every Deer which is found sick, a score have died obscurely.

" The age of a buck greatly affects his appearance. Except in size, weight, and color-shadings, does have no decided marks of age. But the appearance of a buck's neck and head, the form of his hoofs, and the size or symmetry of his antlers will supply definite data concerning his age. It is far from true that the oldest bucks will have the finest horns. I have known bucks which must have been ten years old to have antlers which were decidedly inferior in form and size. On St. Katherine's Island, off the Georgia coast, a friend of mine killed a buck which he declared was so old that it was actually decrepit. The Deer was decidedly gray in color, and its movements had lost nearly all the natural buoyancy of the White-tail. His horns were quite small and crumpled. . . My experience has been that a buck is in prime antler at from six to nine years, and that a six or seven-year-old buck carries the best horns. As a rule, bucks two and a half years old have two prongs, or, as they are reckoned in some States, a beam and a prong. But I have seen bucks of that age with nothing but very long spikes, somewhat resembling Antelope horns. I have also seen a buck with spike horns, fifteen inches long, which met in front, so great was their curvature inward, nor was there any sign to show that the antlers had been forced into that position. It was apparently a natural but an extraordinary growth."

YOUNG VIRGINIA DEER

This photograph was taken from a boat after dark, with the aid of a flash-light

Copyright, by L. A. Myrick

MULE DEER

This herd was photographed from a sage brush blind, while feeding near Grand River, Colo., by L. A. Myrick

MULE DEER

Odocoileus hemionus (*Rafinesque*)

General Description.— A moderate sized deer, with robust antlers and large ears. Tail covered with short hairs, naked on underside and with a black terminal tuft. Metatarsal gland unusually large. Body color yellowish-brown to reddish-brown. High bounding gait. Antlers never developing as many tines as with the White-tailed Deer, but dividing on each beam into two characteristic Y's.

Dental Formula.— Same as given for White-tailed Deer.

Pelage.— ADULTS: *Summer.* Yellowish-brown varying to reddish-brown above. Below blackish. A large patch on rump and surrounding tail dull white. Tail light color of the rump above, terminal one-third black above and below, the hairs forming a tuft or pencil. Inner ear grayish-white, externally same color as head and body. *Winter.* Dark gray above, otherwise about as in summer. YOUNG: General color brownish-yellow irregularly spotted with dull white.

Measurements.— Length, male, 5 feet, 3 inches; tail, 7¼ inches; hind foot, 18½ inches. Height of ear above crown, 9½ inches. Length of female, 4 feet, 9 inches. Weight of average buck, 150 to 200 pounds.

Range.— Northern Arizona to British Columbia in the mountains, foothills and plains.

Food.— Twigs and foliage of shrubs, grass, fruits and plants, and in southern part of range, acorns.

Remarks.— A very different sort of an animal from the Virginia Deer both in appearance and habits. The ranges of these two animals overlap in the Great Plains and in the Rockies as well as in the southern United States, but on the whole they inhabit widely separate areas. The Mule Deer varies in a few characters such as coloration and size, to produce several closely related forms.

RELATED SPECIES

Mule Deer.— *Odocoileus hemionus hemionus* (Rafinesque). The most widely spread form. Found throughout the Great Plains and the adjacent Rockies.

California Mule Deer.— *Odocoileus hemionus californicus* (Caton). Considerably smaller and more tawny. A dark stripe from back along upper surface of tail. Southern California and northern Lower California.

Mexican Mule Deer.— *Odocoileus hemionus canus* Merriam. Smaller, paler and grayer. Texas, New Mexico and Arizona from the deserts up into the mountains.

Burro Deer, or Desert Mule Deer.— *Odocoileus hemionus eremicus* (Mearns.) Very pale, large, with heavy horns. Western Desert Tract of the United States.

Next to the Wapiti and Moose, the Mule Deer is the largest of our American Cervidae. Its limbs are larger and coarser than those of the White-tailed Deer, and it is less agile and elastic in its movements; also less graceful in form. The large disproportioned ears very probably suggested the name of Mule Deer. The most striking difference between the White-tailed Deer and the Mule Deer is found in the antlers. With the Mule Deer the tines from the main beam divide to form two Y's on each beam, whereas in the White-tailed Deer, the tines from the main beam seldom divide.

The Mule Deer was first discovered by Lewis and Clark on September 18, 1804, in latitude 42°, on the Missouri river. They then called it the Black-tailed Deer. On May 31, 1805, they discovered the true Black-tailed Deer, on the Columbia river.

The Mule Deer is considered one of the most imposing of the Cervidae in appearance. It holds its head and neck erect, while its antlers are much wider than those of its white-tailed cousin. In winter its color is a sober gray, changing in summer to soft brown, thus enabling it to blend in with the landscape to a remarkable degree.

This animal is at home in the wildest, roughest and most mountainous country. It frequents both the deep ravines and the mountain heights. "It is a proud-spirited, high-headed animal," says Dr. Hornaday, "a bold traveler, and, like the Mountain Sheep, is often found where the scenery is wild and picturesque. In this respect it differs from the White-tailed Deer, which prefers low ground, and either brush or timber in which to hide."

A large Mule Deer buck, shot by Dr. Hornaday on Snow Creek, Montana, measured forty-two inches high at the shoulders and sixty-two and six-tenths inches in length. A large pair of antlers showed a beam length of twenty-seven and one-quarter inches, spread twenty-nine inches, and had fourteen points. In the United States the present scarcity of really large antlers in the possession of taxidermists is a sure sign of the approaching end of this species.

In 1903, Mr. A. G. Wallihan, a photographer of wild animals, made the following prediction regarding the extermination of the Mule Deer in Colorado, its centre of abundance in the United States: "Unless we have a close season on Deer, five years will see the finish of these animals. Five years would give them a good

start again. I will cite you some figures: In 1897, I was on the big trail here for nine days, and I counted within a few of a thousand Deer. In 1901 I was on the same trail for eighteen days and I counted 228 Deer. In 1902, I was out fourteen days, and counted fifty-two Deer."

The Mule Deer has a peculiar running gait — a progression of stiff-legged leaps, in which the feet come down together to the ground then bound off again like steel springs. But it can run at astonishing speed for long distances. In the chase it will tire out most dogs and wolves.

By permission of the New York Zoological Society

MULE DEER BUCK

Showing the distinctive marking of the crown and muzzle of this species

In the Rocky Mountains, where the true Black-tailed Deer is not known, the Mule Deer is still referred to as the Black-tailed. On the Pacific Coast, where it is found on the same range as the Columbia Black-tailed Deer, it is known by its true name.

The most natural home of the Mule Deer is in the mountains, but before the occupation of the country it frequented the Great Plains. West of the Rocky Mountains this species of Deer is still met with in many localities. In the coast range north of San Francisco it is almost entirely replaced by the Columbia Black-tailed Deer. In Oregon, Washington and British Columbia the Mule Deer is not so numerous as in the Rockies further east.

This Deer may produce two fawns at each birth, but in past years its breeding has nowhere near kept pace with the rate of killing, and it seems doomed to extinction.

The Mule Deer was one of the strange animals noted by Audubon and his companions on their memorable journey up the Missouri river, in 1843. He says of his first sight of it: "On winding along the banks, bordering a long and wide prairie, intermingled with willow and other small brushwood, we suddenly came in sight of four Mule Deer which, after standing a moment on the bank and looking at us, trotted leisurely away, without appearing to be much alarmed. After they had retired a few hundred yards, the two largest, apparently males, elevated them-

selves on their hind legs and pawed each other in the manner of the horse. They occasionally stopped for a moment, then trotted off again, appearing and disappearing from time to time, when becoming suddenly alarmed they bounded off at a swift pace until out of sight. They did not trot or run as irregularly as our Virginia Deer, and they appeared at a distance darker in color."

Mr. A. G. Wallihan says of this species: "For me, at least, there is a charm about the Mule Deer that no other game possesses. Barring the Bighorn, their meat is the best, their hide tans into the best buckskin, and you turn from the large Elk or the agile Antelope to the graceful beauty of the Mule Deer buck, and find there the greatest satisfaction. The head of the Bighorn is a finer trophy, no doubt, and you are led to grand scenery in the pursuit of him, but it is heart-breaking work. Where you find the Mule Deer you will find other pleasures, for he delights in the most charming bits of country to be found. He will jump up from the tall weeds and grass among the aspens, so close as to startle you as you ride through them, or will leap into view from the shade of a deep washout far in the desert, where he finds in the feed and surroundings something to suit his taste. He is crafty also, for if he thinks he is hidden I have known him to lie in thick bush until almost kicked out, after all sorts of experiments to drive him out have failed. He has perhaps the keenest scent and the best hearing of all the Deer tribe, but cannot see as well as the Antelope, for I have stood within ten or twenty feet of several passing bands, which failed to distinguish me from a stump or rock. Antelope will approach very close occasionally, out of pure inquisitiveness, but never a Deer. If anything moves, a Deer sees it instantly, but he cannot tell the nature of a still object. This often places him at a decided disadvantage."

Photograph by Mrs. Howard A. Colby

AN EARLY BREAKFAST

White-tailed Deer, on the shore of Umbazookakus Lake, Maine. Time exposure with a telephoto lens, at five o'clock, on an August morning

COLUMBIA BLACK-TAILED DEER

Odocoileus columbianus (*Richardson*)

General Description.— A large Deer with heavy antlers on the male. Tail longer than that of Mule Deer and much broader. Ear normal. Body and legs short. Body color yellowish-red.

Dental Formula.— Same as given for White-tailed Deer.

Pelage.— ADULTS: *Summer.* Above, yellowish-red to dull reddish-brown. A dark streak on throat, darkening on the breast and becoming brownish on the belly. A white area extending from between the thighs to the tail. Tail with upper side brown on basal half, dull black on remainder, and white on under side. *Winter.* Above, gray tinged with tawny, darker on upper side of neck. YOUNG: Bright bay spotted more or less regularly with white.

Measurements.— Length, 6 feet; tail, 6 inches; height at shoulder, 2 feet, 10 inches.

Range.— Coast Mountains from northern California to British Columbia.

Food.— Grass, leaves, buds and twigs of shrubs and trees.

Remarks.— The Columbia Black-tailed Deer may be readily distinguished from the Mule Deer by its smaller ears, smaller metatarsal gland (2 to 3 inches long in the Black-tail, 5 inches long in the Mule Deer), and longer, broader tail with a white underside and no naked area. The group of Deer, of which the Columbian Black-tailed is typical, is made up of 4 species and subspecies.

RELATED SPECIES

Columbia Blacktailed Deer.— *Odocoileus columbianus columbianus* (Richardson). Type form. Coastal region from California to British Columbia.

Southern Black-tailed Deer.— *Odocoileus columbianus scaphiotus* Merriam. Ears larger and broader, color paler, teeth larger. Southern California.

Alaska Black-tailed Deer.— *Odocoileus columbianus sitkensis* Merriam. Alaska.

Crook Black-tailed Deer.— *Odocoileus crooki* (Mearns.) Smaller, paler and ears larger. New Mexico and Arizona.

This deer, the most common on the Pacific slope, was discovered by Lewis and Clark in 1805, when in the region of the Columbia river, and is described in their list of fauna observed by them as the "Black-tailed Fallow Deer." It is remarkable for having the most limited range of all the Deer of America, being found in British Columbia and on the Pacific Coast only. In southern Oregon it has been seen a few miles over the crest of the Cascade range, as far east as Klamath Lake, and in most abundance about forty miles east of Cottage Grove.

The Columbia Black-tail is generally smaller than the two other types. Its ears are large, and its eyes are perhaps the most beautiful of all the Deer family, being large, and a brilliant liquid black. The weight ranges from 175 to 225 pounds; an exceptionally large buck scaled over 270 pounds. The antlers, which are neither so large nor so handsome as those of the Mule Deer, vary considerably in size; a pair twenty-three inches long and having a spread of twenty-four inches would be considered good. They are bifurcated sometimes once, sometimes twice, and are shed annually in the spring. Forthwith the bucks make their way to the higher mountains remaining in the thick brush for five or six weeks, in which short time the new horns attain their full growth, but are, of course, still in the velvet. The Indians are said to be fond of the soft horn, and hunting dogs must be kept from it, as they regard it with evident liking.

In winter, the color of the animal is a beautiful steel-gray, the face being gray with dark forehead; the throat and underparts are white, and the legs dark cinnamon. The tail, which is the distinguishing feature of this species of Deer, is round, and a dull black, except for about a quarter of its circumference on the under side, which is white. As the tail of the Mule Deer is also black, hunters not infrequently mistake that animal for the Columbia Black-tail; but there is this distinct difference between the two: the tail of the Mule Deer is naked underneath, while that of the Columbia Black-tail is entirely covered with hair.

The mating season is from late September to November, the actions of the bucks at this time being almost ludicrous. "With bulging eyes and widespread legs, they plunge through the forest as if possessed of an unclean spirit — hardly noticing even a hunter when they meet him, or, if they should do so, plainly showing that they would almost as soon fight as flee." The does are very prolific, producing, in the spring, two, and not uncommonly three fawns at a birth. The fawns are beautifully marked with almost white spots, which they retain for four or five months. So long as the does are nursing, the Deer lie very close, but the bucks do not appear to trouble

themselves much about the welfare of their offspring.

The Columbia Black-tail is a cautious and wary animal in the forest and where much

Photograph by E. R. Warren

MULE DEER

A handsome, well-proportioned species noted for its fine antlers

persecuted, but where unmolested it is exceedingly tame. When chased, however, it tests all the ingenuity of the practiced hunter, and in "dodging into unsuspected ravines, twisting around big rocks, and dashing over logs, the Black-tail is equalled only by the Mule Deer."

While not strictly nocturnal, this Deer is a night rover and loves a good moon. It then can get all the exercise it requires before daylight, and lies down during the day. It cares little for grass, but delights in the tender twigs and leaves of the huckleberry, salal, and in evergreen foliage generally. In the natural park at Vancouver it has been seen to feed on "the foliage of spruce, Douglass fir, and juniper in succession," and where little molested it has been known to go down to the shore to feed on a certain kind of seaweed. In many of its haunts the browse is so succulent that the animal can go for days without drinking.

An interesting fact has been noticed respecting this Deer in the region of the Cascade mountains, in Oregon. A large number migrate every spring to the high mountains, returning thence before the snow begins to get deep; the others remain all summer in the Coast range, and the condition of both bands is equally good. Like the Moose and Wapiti, the Columbia Black-tail "yards" in the winter, and the Indians, taking advantage of this fact, slaughter it in great numbers, especially in the region of the Bitter Root and Coeur d'Alene Mountains. The animal is now protected in all the States where found, and owing to the unfrequented nature of many of its haunts, it seems to be in no danger of extinction.

It should be mentioned that the Columbia Black-tail is a "bounding" Deer, that is, all of its four feet strike the ground together. This gait, which has earned for it in Manitoba the name of "Jumping Deer," has not changed in the last hundred years, Lewis and Clark having recorded that it "does not leap, but jumps like frightened sheep." It is a dangerous animal to approach when wounded. Mr. Thomas G. Farrell relates an experience of his in southern Oregon: "Poor H—— was hunting on the same ridge that I was on. I saw him fire at a buck, and as it fell, he laid down his gun, and drawing his knife, ran up to the animal to cut its throat. I shouted to him to be careful, at the

BLACK-TAILED DEER

The Black-Tails have a general resemblance to the Mule Deer, but are a trifle smaller

same time making my way rapidly in his direction. My warning was too late, however, for, as he approached it, the buck suddenly rose to its feet, and, jumping against the hunter, hurled

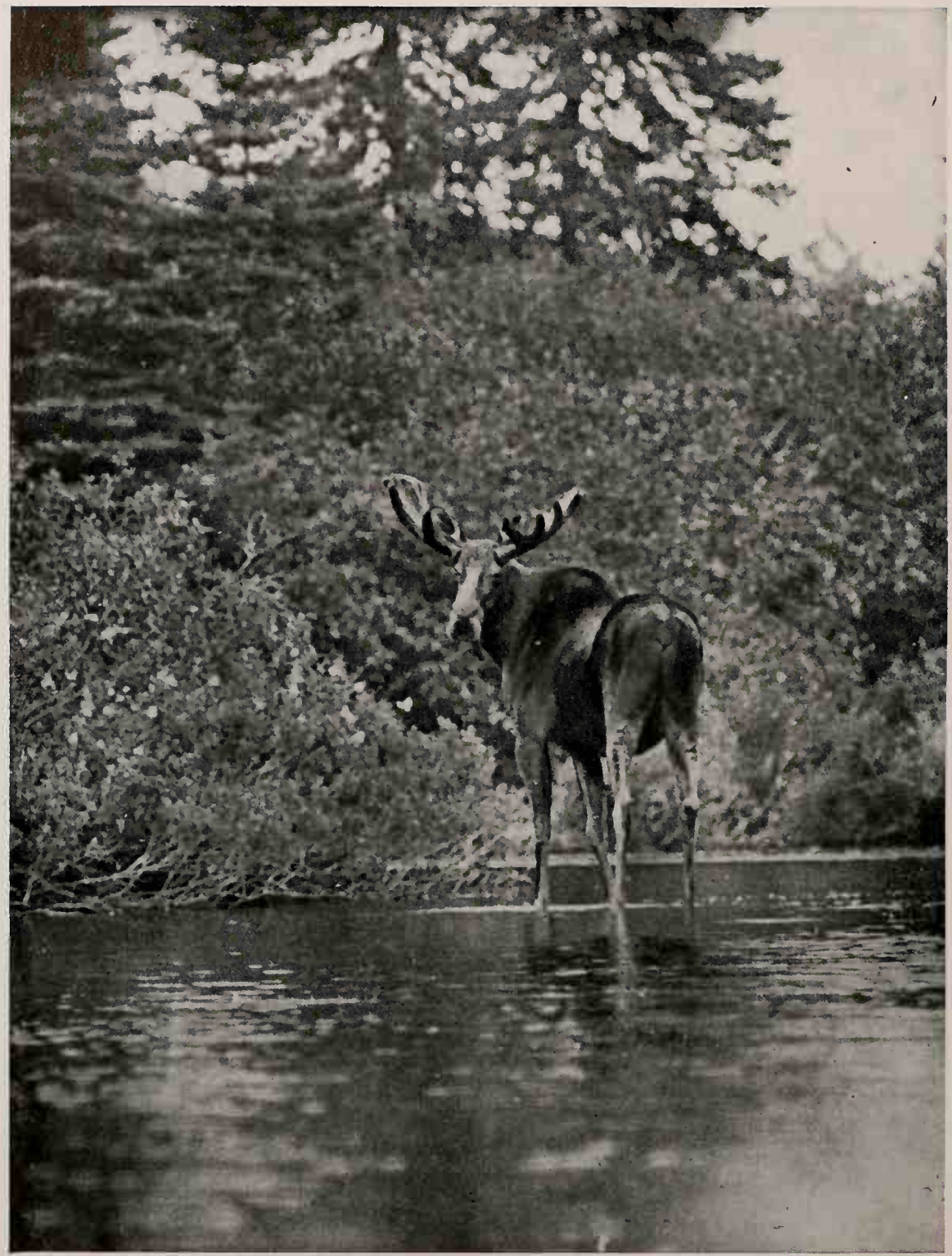


Photo copyright by Wm. Lyman Underwood

A BULL MOOSE SURPRISED

An unsual picture in which the photographer risked being charged upon by the unwilling model

him to the ground. The next instant the animal bounded into the air, and came down with all four feet on the prostrate man. At this instant, one of the party fired at the animal and killed it. We had to carry the wounded man sixty miles on a stretcher, and he never fully recovered from his terrible experience."

In Alaska there is a smaller form of the animal known as the Sitka Deer, which is less in stature and has smaller antlers than even the Florida White-tail.

In southern California the related species is known as the Southern Black-tail. Its ears are larger and broader than those of its northern cousin, and its color is not so distinct.

In New Mexico and Arizona others are found of much the same marking as the southern. These are known as the Crook Black-tail Deer.

MOOSE

Alces americanus *Jardine*

General Description.— Largest of the American Deer. Antlers, on male only, excessively broad and heavy, palmate. Tail short. Muzzle inflated, broad and pendulous. Nasal pad haired except extreme lower portion. A hanging growth of skin and long hair, the bell, on throat. Higher at shoulders than at rump. Long pointed hoofs, well developed lateral hoofs. Color black or dusky. Ears large.

Dental Formula.—Incisors, $\frac{0-0}{4-4}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3} = 32$

Pelage.—Adults: *Winter.* Sexes similar in color. General color from blackish-brown to black. Below same color as above, except for pale brownish-gray on lower belly. Lower legs brownish-gray. Varying amounts of gray on muzzle and face. Short hair over all the nasal region with the exception of a small triangular naked space between nostrils. *Summer.* Similar in pattern, but color somewhat lighter, and legs tawny gray. Young: Reddish-brown, unspotted.

Measurements.— Male, length, 8½ to 9 feet; tail, 2½ inches; height at shoulders 5½ to 6½ feet; average adult spread of antlers, 52 to 58 inches; record heads, 65 to 78 inches. Female, about three quarters the size of the male.

Range.— British America and northern United States from Maine to the Rockies. Formerly south in New England to Massachusetts.

Food.— Foliage and twigs of shrubs and trees; aquatic plants.

Remarks.— The Moose of North America are forest inhabiting, water-loving animals, easily distinguished by their great size and peculiar characters from any other of the *Cervidae*. Three species are known.

Related Species

Common Moose, or American Moose.— *Alces americanus americanus* Jardine. The typical animal ranging from the northern United States east of the Rockies north to Hudson Bay.

Shiras Moose.— *Alces americanus shirasi* Nelson. Smaller, with pale brown back, pale ears, and small hoofs. Wyoming, in the Yellowstone Park region, Montana and Idaho.

Alaska Moose.—*Alces gigas* Miller. Noticeably larger than the common form; blacker. Kenai Peninsula, Alaska.

The Moose is the giant among Deer; the killing of one is the realization of the deer-hunter's highest ambition; and a head with its magnificent antlers is unexcelled as an interior decoration of the home, the club, or the hall. Those who have seen the animal only in our natural history museums or zoological parks can hardly realize the imposing appearance of an adult male "full of strength and purpose, striding like a four-legged Colossus through the evergreen forests of Canada or Alaska, or swinging away at incredible speed from the dangers of the chase." No other species of Deer roams through so wide an extent of forest country of the northern portion of the North American continent. From Alaska southward to Wyoming (in latitude 43°), and eastward through Canada, northern Minnesota, Maine, New Brunswick and Nova Scotia, the Moose in one or other of its species is to be found. In British Columbia, Washington, and southern and southeastern Alaska they do not approach the coast, but in the Alaska and Kenai peninsulas their range is down to the sea.

The Common Moose, which is now most numerous in New Brunswick, Maine and lower Canada, is not so large as his brother, the Alaska Moose of the Kenai Peninsula, so far as antlers are concerned. One of the tallest and largest moose ever killed and measured by reliable hands was a Common Moose shot in New Brunswick by Carl Rungius, the well-known animal painter. The measurements of this animal were as follows: Length of head and body, nine feet seven inches; length of head alone, two

feet nine inches; height at shoulder, exactly seven feet; girth, eight feet. The antlers were somewhat small for so large an animal. Incidentally it may be stated here that the largest moose antlers known are in the Field Columbian Museum, Chicago, which gives their dimensions as: Widest spread, seventy-eight and one-half inches; palmation, greatest width, sixteen inches; burr, circumference fifteen inches; total number of points, thirty-four. They were those of an Alaska Moose from the Kenai Peninsula. An average specimen of the adult Common Moose stands about five feet, nine inches at the shoulders, and one over six feet would be a very fine animal. The weight of the male often exceeds 1000 pounds. The females are smaller than the males. In both, the nostrils are large, and the muzzle hairy and long.

In color the Common Moose is lighter in Maine and lower Canada than it is farther west. The head, neck, and body are blackish-brown; the legs and under parts yellowish-gray, and in some cases almost white. The hair is very coarse, and is six inches long on the neck and shoulders. From the neck depends a pouchlike piece of hair-covered skin, called the "bell."

The Common Moose is an ungainly creature. Its front legs are considerably longer than the hind ones, rendering its gait extremely awkward; but their length, quite four feet, enable it to stride with facility over fallen trees in the forest which prove annoying obstacles to its pursuers. Its overhanging, square-ended nose, large ears, and a hump on the shoulders, all add to its ungainliness. Its ordinary gait is a long, springy trot, but it will walk for long distances with great strides in a straight line across the marsh, splashing among the wet water plants, and ploughing through boggy spaces with the indifference begotten of vast strength and legs longer than those of any other animal on this continent.

The Moose is a browsing animal, its legs being too long and its neck too short to allow it to graze; yet in the early spring, when greedy for the tender blades of young, green marsh grass, the Moose will often shuffle down on its knees to get at them, and it will occasionally perform the same feat to get a mouthful of snow in

By permission of the New York Zoological Society

COW MOOSE

Neither sex of the Moose family can be called handsome, but of the two the female is the more gaunt and ungainly

winter. In Maine and lower Canada it feeds extensively in the summer on pond lilies and other plants in the marshy lakes; sometimes when feeding in a pond or lake it will go completely under the water and out of sight after its favorite lily root. In the forests it feeds on moss and lichens and on the twigs, leaves, and bark of certain trees, such as willows, alders, and aspens. It is a powerful swimmer, and is especially fond of wading in shallow water.

The Moose is usually monogamous, and the mating season begins in September. The bulls at this time become absolutely reckless, and do battle royal for possession of the cow. The clashing of their antlers may sometimes be heard a mile off. The bulls seek the cows, uttering continually a short, loud roar, which can be heard at a distance of two or three miles; the cows now and then respond with low, plaintive bellows. Hunters and photographers of the Moose summon the animal to them by imitating the call of the bull, on a horn made of birch bark. It has been a disputed question as to whether this call really deludes the Moose. The calves are born in May and usually remain with the cow till the second year. One or two at a birth is the usual number, very occasionally there are triplets.

An eye-witness to a fight between two bull Moose gives (in *Field and Stream*) the following vivid description of the contest: "For a brief space they eyed each other with lowered heads, pawing the ground savagely meanwhile. The great ears hugged the bristling necks. Slowly they approached each other like two trained wrestlers waiting for an opening. Suddenly the gray bull with lowered antlers charged at a distance of ten yards. The other, not a whit behind his rival in courage, sprang to meet the onslaught. So evenly matched were they in size and strength that at the terrific impact each was hurled back and almost upon his haunches. The gray Moose was the first to recover himself. Again their antlers crashed together, resounding far throughout the quiet moonlit woods.

"It now became a test of strength. The first to give way would surely lose the fight, for once started backwards his hinderparts would sooner or later come in contact with some obstacle that would cause him to swerve, when the other would have a chance at his unprotected side.

"The earth spurted up from their straining cloven feet, yet not a sound was made by either other than the tramping and labored breathing. With a deep knowledge of the game they strove to keep head-on. Around and around they struggled until the grass and leaves were trampled out of sight. At last in one of these evolutions the rump of the stranger struck against a tree, preventing him from swinging to keep in line with his antagonist. The neck muscles, though tremendously powerful, could not hold his adversary. He struggled to recover himself but without avail. The tree that had been his ruin prevented him from leaping sideways and thus escape the onslaught. The antlers of the gray Moose slipped around his neck, one of them catching him forward of the shoulder, and the other just back of it. With a

Photograph by G. W. Visser

MOOSE SWIMMING

The Moose is not so pugnacious when in the water, and this one was snapped while busily getting away from a canoe

surge the gray Moose drove his antlers home. Nothing that lived could withstand that fierce vindictive thrust. Through hair and hide and flesh those terrible points sank. The stranger reared to avoid the shock. That action, together with the tremendous lifting stroke, threw him with a crash full upon his back. As he went over the curved points ripped out of the wounds, lacerating the flesh. The lungs were pierced, but he struggled to his knees, and while in that defenseless position the gray Moose struck him full in the side in a maddened charge. As he made no motion to rise the gray Moose drew off and watched him for a moment, then turned to where the cow stood, who had been apparently an uninterested spectator of the fight."

The Moose has several enemies, among them being the Bear, the Cougar (the most dangerous where both animals are at all plentiful), and the big Timber Wolf. Man, of course, is its most dreaded foe, though owing to the excellent game

laws of many of the States, notably those of Maine, the Moose is now no longer in danger of extermination. It is hunted by several methods: calling (referred to above), still-hunting, fire-hunting from a canoe, and "crusting." The last two methods are considered unsportsmanlike. Crusting often degenerates into mere butchery, the animal breaking through the crust of snow and becoming helpless before its pursuers. Hunters who employ this method are often charged by Moose. They follow the animals on snowshoes during the late winter and early spring when the Moose have "yarded." A "yard," it should be explained, is a spot chosen by a Moose herd for their winter home because it contains plenty of browse and is sheltered from heavy snowdrifts. Across this space the Moose travel to and fro, making regular, beaten paths.

On the general question, "Will Moose attack man without provocation?" Colonel Roosevelt throws some light in an article in *Scribner's*, in which he says: "When half a mile from the landing we saw another big bull Moose on the edge of the shore ahead of us. We paddled up to within a hundred yards of it. Then it looked at us, but paid no further heed. We were rather surprised at this, but paddled on past it, and it then walked along the shore after us. Another hundred yards put us to windward of it. Instead of turning into the forest, when it got our wind, it merely bristled up the hair on its withers, shook its head, and continued to walk after the canoe along the shore. I had heard of bull Moose during the rut attacking men, but never of anything as wanton and deliberate as this action, and I could hardly believe the Moose meant mischief; but Arthur said it did; and obviously we could not land with the big, black evil-looking beast coming for us. I was most anxious not to have to shoot it. The Moose turned and followed us, shaking his head and threatening us. As soon as we stopped, he rushed down the trail toward us, coming into the lake. Where the water was deep, we pushed the canoe in close to him, and he promptly rushed down to the water's edge, shaking his head and striking the earth with his fore hoofs."

COW MOOSE

This Cow was lured to within fifteen feet of the camera by the operator, who grunted like a Bull Moose

For more than an hour the animal prevented the occupants of the canoe from landing; then he galloped — not trotted — away. A couple of hundred yards on, the beast reappeared, and as we approached he struggled to his feet, grunting savagely, and I killed him as he came to us."

In forest preserves the Moose will thrive, but in zoological parks it seldom survives longer than

By permission of the U. S. Biological Survey Drawing by Carl Rungius

ALASKA MOOSE

The Alaska Moose is the largest of its tribe. This spirited drawing shows a characteristic attitude

after firing over its head without scaring it in the least, the Colonel " put a bullet into his chest. It was a mortal wound and stopped him short. I fired into his chest again. He turned and recrossed the stream, falling at a third shot; but

five or six years, usually dying of some affection of the stomach and intestines, although fed on " the best tree branches that its own native forests can supply." It is docile in captivity and has been trained, like the Wapiti, to run in harness.

The Alaska Moose differs from the better known form by being larger and darker in color. This animal reaches proportions almost gigantic, and when at bay in the woods is a foe to be dreaded. Its home is the Kenai Peninsula of Alaska.

"The broad valley and mountain banks of the Klondike," writes Tappan Adney, "are an admirable feeding ground for this Moose. The temperature in winter is exceedingly cold and crisp, but the snowfall is light, and by reason of the intense cold the snow does not settle or pack. There is so little wind, especially through the early part of the winter, that the snow accumulates on the trees in strange and often fantastic masses, giving the landscape, especially on the mountain tops, the appearance of having been chiseled out of pure white marble. On account of its lightness, the snow is no impediment to the long-legged gaunt Moose, which is not obliged to 'yard' as in more southern deep-snow regions, but wanders at will from valley to mountain top in search of the tender twigs of willow, white birch or cottonwood. The Indians surround the Moose in its feeding grounds and as it runs, one or more of them is tolerably sure of a quick shot." The Moose in this section have long been the main support of the Indians, and in their household economy no part of the beast is wasted. To quote further: "The hides were brought indoors, the hair was shaved off, and all the sinew and meat adhering was removed by means of a sort of chisel made of Moose's shin bone. . . . The skin was now washed in a pan of hot water. The various portions of the Moose were divided among the village. One family got the head, another a slab of ribs, another the shoulders. The shin bones were roasted and cracked for their marrow; the ears, although nothing but cartilage, were roasted and chewed up; the rubber-like 'muffle' or nose, and every particle of flesh, fat or gristle that could be scraped from head or hoofs were disposed of. Even the stomach was emptied of its contents, boiled, and eaten."

A near relative of the Alaska Moose is found in the forests of the Scandinavian Peninsula, as well as parts of Russia and Prussia. The animal is known to the English by the name of Elk, which term has unfortunately been applied in this country to the Wapiti, an animal presenting many points of difference.

WOODLAND CARIBOU

Rangifer caribou (*Gmelin*)

Other Name.— American Reindeer.

General Description.— A large Deer, the male weighing about 300 to 400 pounds. Antlers palmate, found on both sexes, those of male wide and branching, of female much smaller, occasionally lacking entirely. Brow tine present, compressed laterally. Muzzle haired, wide and heavily built. Ears and tail short. Mane on neck. Tarsal but no metatarsal gland. Hoofs broad and long, deeply cleft, with accessory hoofs reaching nearly to ground.

Dental Formula.—Incisors, $\frac{0-0}{4-4}$; Canines, $\frac{1-1}{0-0}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3} = 34$.

Pelage.— Adults: Sexes similar. *Summer.* Greater part of animal dark brown, with grayish-white to pure white on neck from ears to shoulders. Area about under side of tail, belly and extremities of limbs whitish, the white about hoofs arranged as a band. Black patch on cheek and about eye. *Winter.* Head and neck whitish, rest of body grayish-ash to dull grayish-brown. Long hairs very coarse everywhere. Inner coat of fine hair present. Young: General body color about as in adults, but with faint traces of white spotting.

Measurements.— Length, male, 6 to 6½ feet; height at shoulder, 42 to 48 inches; length of tail, 4 inches; antlers, 32 to 42 inches. Female, slightly smaller.

Range.— Labrador, region between Great Lakes and Hudson Bay extending from Maine to Montana and British Columbia, in forest lands.

Food.— Practically any green vegetation to be found in its range.

Remarks.— This animal is well marked off from other Caribou to the north by its greater size and larger horns, and from the Caribou to the west by its color and smaller size. There are many species of the Woodland group, but some are only slightly differentiated.

Related Forms

Woodland Caribou.— *Rangifer caribou caribou* (Gmelin). Typical form. Canada from Maine to Rocky Mountains.

Richardson Caribou.— *Rangifer caribou sylvestris* (Richardson). Differing little from typical Woodland Caribou. Southern shores of Hudson Bay.

Mountain Caribou.— *Rangifer montanus.* Seton-Thompson. Size very large, color very dark, horns massive. British Columbia.

Osborn Caribou.— *Rangifer osborni* Allen. Very large in size, exceeding the Mountain Caribou. Antlers very long and heavy. Cassiar Mountains, British Columbia.

Peary Caribou.— *Rangifer pearyi* Allen. Pure white except for large dark patch on mid back. Known only from 4 skins. Ellesmere Land.

Stone Caribou.— *Rangifer stonei* Allen. Dark in coloration with heavy fringe of white hairs on front of neck. Antlers long and not especially massive. Kenai Peninsula.

Dawson Caribou.— *Rangifer dawsoni* Seton-Thompson. Size very small, color dark. Queen Charlotte Islands.

Alberta Caribou.— *Rangifer fortidens* Hollister. Largest of the North American Caribou. Coloration very dark. Antlers stout, heavily palmate. Females normally without antlers. Alberta.

Newfoundland Caribou.— See description which follows.

Barren-Ground Caribou.— See description which follows.

Scandinavian Reindeer.— See description which follows.

This Caribou, which is the original type of the Woodland Caribou group, is a large and powerful animal, about twice the size of a Virginia Deer. A typical specimen, from Maine, in the Zoological Park, New York, is described as "a strong lusty animal, forty-eight inches high at the shoulders, weighing 280 pounds, and endowed with sufficient energy to vanquish the strongest man in about one minute." The Woodland Caribou is an odd-looking creature. Its head, long and resembling somewhat that of the cow, is carried low and thrust forward; its shoulders are high and sharp. Its hoofs, which are cleft nearly to the hocks, make, as it walks on the hard ground or withdraws them successively from the ooze of a marsh, a distinctly clicking sound.

When not suspecting danger, the Woodland Caribou has a careless, slouchy gait and, it must be confessed, an unattractive appearance; but when it scents a foe "the listless, careless pose gives place to one animated and full of spirited attention; the head is carried proudly aloft, crowned by its noble weapons of offense and defense. . . . And then, the foe appearing, how grand is the animal's movement as, in a stately trot, with head and tail uplifted, the proud Deer passes rapidly from view over the yielding moss."

The antlers present some noticeable differences from those of the Barren-Ground species, being generally "short in the main beam, liberally palmated both on brow-tines and tips, and have upwards of thirty points. As a whole, the antlers have a tree-top appearance."

One of the Woodland group, the so-called Osborn Caribou, is supposed to be the largest of Caribou; it has a height of fifty-five inches at the shoulders.

The summer coat of the Woodland Caribou is of a dark gray, with white under parts and a white caudal patch. In winter the body changes to a very light hue, and the neck becomes almost pure white. The color of the pelage varies considerably in different members of the group. The Black-faced, or Mountain, Caribou of southeastern British Columbia is, in September, nearly black, while the Barren-Ground is the whitest of all Caribou.

The female also may have antlers, though smaller. Antlers are shed between January 1 and the end of February, the new ones growing slowly till the warm weather comes, when they lengthen rapidly, attaining full size about September 1st. The animal removes the velvet, or soft covering, by rubbing its antlers against the trees, and is then ready to do battle. The pairing season begins in September, and usually one fawn is born each year. Occasionally two are produced.

The Woodland Caribou, unlike his Barren-Ground brother, is a wide-awake animal. In districts where his chief enemy, man, has not molested him he is confiding. His "first inclination on seeing an intruder is to come up and play with him." Mr. Charles Sheldon in the Upper Yukon district saw a Caribou with her young one which came twenty-five yards toward him, looked at him indifferently and then trotted off. When surprised, the animals seem to become panic-stricken and unable to escape; but as soon as they scent danger they are off. On the ice they are exceedingly swift, soon outdistancing the hunter. The Woodland Caribou is a forest rover, and is usually found in the swamps. The Cree Indians call it the Swamp Deer. They seek the mountains in the spring, and spend their summers above the timber line, hiding in dense thickets in the day and coming out at night to wander about and to drink of the nearest lake. In the autumn the Caribou leaves the heights for

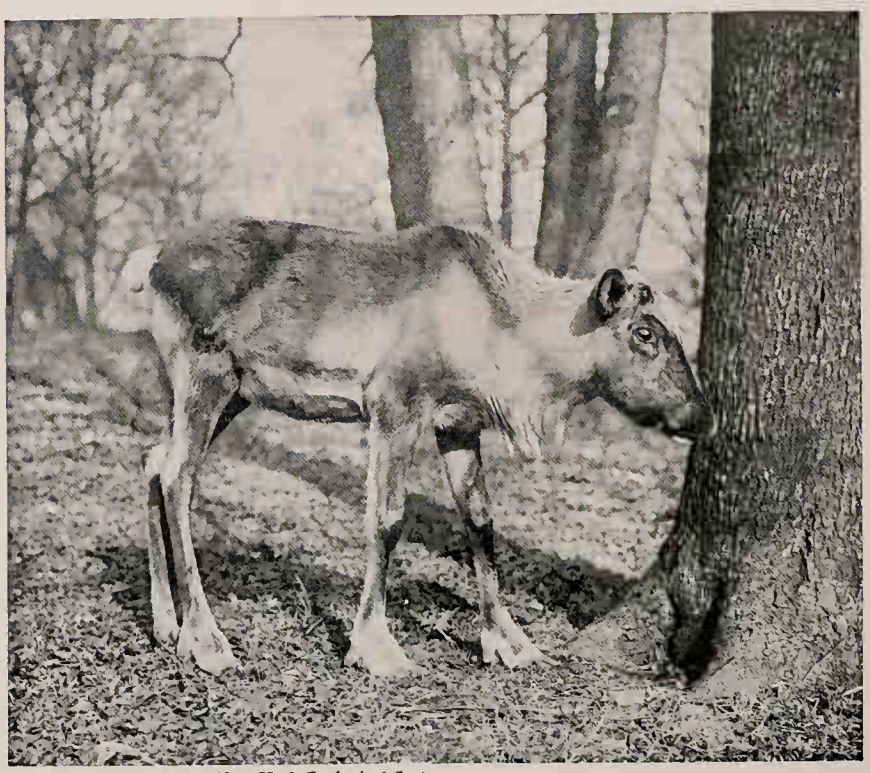
the valleys, where it can more easily obtain food. It feeds on lichens, leaves, and berries, and is especially fond of cranberries. The animal is hunted by stalking, still-hunting, and on snow-shoes, and of late years its numbers in many districts have become greatly reduced.

No instance is known of the domestication of the Woodland Caribou, but the following incident is related of an attempt in this direction:

"The proprietor of a camp in the Maine woods had been much teased about the loss of useful labor he was incurring through not taming the Woodland Caribou. Shortly after, having trapped two fine animals, he proceeded to attach a rein, in the shape of a lasso, to one of the untamed creatures. Unfortunately, the Caribou reversed the order of things and taught the trainer a lesson. Slipping the lasso to his flanks, he made a bound of twenty feet, carrying his trainer like the tail of a kite, in a straight line after him. He dropped him, only to make a second leap, and a third finished the business."

The camp proprietor picked himself up, bruised from head to foot, and this was his first and last attempt at taming Woodland Caribou.

The flesh of this Caribou makes excellent venison and is much used by the northern Indians. In gait it resembles the Elk and Moose more than the smaller Deer. It travels with a long swinging trot, and goes much faster than it appears. The Caribou has good bottom and can travel great distances without a halt, so that it is almost useless to try and follow a band when once they have taken the alarm.



By permission of the New York Zoological Society

WOODLAND CARIBOU

This animal has recently shed its horns, and is not altogether happy about it

Like the Antelope, the Caribou sometimes exhibits curiosity. Mr. Ward, referring to this says: "The indifference or curiosity with regard to the noise of firearms exhibited by the Caribou often stands the hunter in good stead and affords him a chance for a second shot, should the first prove ineffectual; for it is not uncommon for a herd to stand stock-still on hearing the report of a gun, even when one of their number has fallen a victim thereto. The pause is but for an instant, and the hunter must be quick to take advantage of it, or his chance will be gone before he is aware of it, for, recovering quickly from the shock or alarm, or whatever it may be, the herd will dash off at a rattling pace."

From a painting by Carl Rungius

THE SENTINELS

The Barren-Ground Caribou is a hardy animal, living in the treeless wastes of Arctic America. They migrate in large herds.

NEWFOUNDLAND CARIBOU

Rangifer terrænovæ *Bangs*

General Description.— See general description of Woodland Caribou. Antlers massive with many points, general shape low, widely spread and points directed forward. Color lighter, more white on feet.

Dental Formula.— See dental formula given for Woodland Caribou.

Pelage.—ADULTS: *Autumn.* Body above grayish-brown, lighter on flanks and nearly pure white on ventral surface. Neck all around soiled-whitish, rather lighter in front; broad faintly defined eye-ring. Lower face, nose and terminal part of lower jaw grayish-white. Under surface of tail and buttocks white. Feet white. Front and outer surface of limbs brownish-gray.

Measurements.— About the same as Woodland Caribou

Range.— Newfoundland.

Food.— Leaves, twigs and moss.

Remarks.— A heavy-antlered relative of the Woodland Caribou.

Newfoundland is one home of the Caribou where, thanks to the excellent game laws in force, it will be able to exist secure from the probability of extinction for many years to come. Mr. J. G. Millais, writing in 1907 ("Newfoundland and its Untrodden Ways"), considered 200,000 to be a fair estimate of the number of animals of this species then on the island. Every native is allowed to kill three Caribou, but the total annual slaughter is estimated at not more than 6 per cent. Naturalists are indebted to one sportsman, Mr. A. A. Radclyffe Dugmore, for an intimate account of the life of this Caribou. It should be explained that he hunted with a camera, and the results of his campaigns are given in his "The Romance of the Newfoundland Caribou."

A good stag of the Newfoundland species stands four feet high at the shoulder, and its length varies from six feet to nearly seven feet. Its weight would be between 300 and 500 pounds. The does are less, both in size and weight. The color of the pelage varies so much, both with the seasons and in individual animals, that only an approximate description can be given. In summer, it is generally a rather dark mouse-gray, shading to almost white on the flanks. There is a white ring round the eyes, and the ears are very light gray. In autumn, the white neck is conspicuous on the stags, less noticeable in the does. The flanks and underparts are white or very light buff-gray, shading upward to the shoulders, back, and the upper part of the hips, which are all of a warm gray or brown. The tail is about seven inches long and conspicuously white. The nose is white or nearly so; the throat and below the ears nearly always white, as is also the throat mane. This mane varies in length from two to twelve inches. The legs are sometimes light and sometimes dark. The winter coloring is very light gray or white.

Of the antlers Mr. Dugmore says: "In a general way the Newfoundland stag carries a more massive antler than that carried by even its closest cousins." Quite a number of the does are hornless, as many as twenty-four without horns having been counted in a herd of 300.

The mating season is in October, the first three weeks. The stag "believes in a plurality of wives — a great plurality; in fact, as many as he can keep under control." Sometimes the stags leave all their does and take possession of an entirely new herd. Fighting for the possession of the does is not at all uncommon, and Mr. Dugmore photographed two stags in the thick of such a conflict. Unless a heavy snowfall occurs, the Caribou remain near their summer quarters up in the higher lands until the rutting-time is over. With the first heavy fall after the middle of October the migration southward to the winter home begins. The animals move in groups of two and three to herds of 100 or more. Each herd is usually led by a doe. Sometimes the pairing season and the migration occur together. At this time the stag presents "a striking contrast to the shy, retiring creature of the preceding months; and yet even greater contrast to the woebegone, miserable beast of the succeeding weeks. . . . It is indeed difficult to believe that this is the same animal, so great is the change. And yet the sportsmen who hunt the Caribou usually see them at no other time. How can we wonder at the wretched drawings so frequently seen supposed to represent the mighty stag?" On the migrations each herd has its sentry. Their speed "is not less than five or six miles an hour when they walk, which is their usual gait; only under rather exceptional circumstances do they trot for any distance, while they seldom resort to galloping unless they are frightened. On warm

WOODLAND CARIBOU

A stag and two fawns making for dry land

days they take things easy, traveling in the most leisurely fashion, and spending the greater part of the day in resting and feeding, particularly between the hours of nine and three." Their favorite food is the reindeer moss. When winter comes, and the snow is too deep for them to dig out their ground moss and lichens, they turn to the tree-growing mosses, such as the Usnea, or Old Man's Beard. When "the winter begins to break, the days become longer, the nights less bitter, and the Aurora Borealis is no longer seen, the Caribou becomes restless; the large herds break up, and in ones and twos the does begin the long return journey to their summer homes in the north."

The young Caribou are born in June; generally there is but one fawn, occasionally twins are produced; the nursery being in the thick forests of spruce. The Caribou has few enemies in Newfoundland. "Wolves are practically extinct on the island; the Lynx is rare, but its extreme cunning makes it a danger to be dreaded. . . The chief enemies are . . . mosquitoes and several species of flies, some of which cause intense annoyance and suffering." The does nurse their young as late as November. The summer months are spent in the higher regions, where, "often hidden away among the forests, marshy barrens abound, and nearly all are sprinkled with small ponds and lakes."

BARREN-GROUND CARIBOU

Rangifer arcticus (*Richardson*)

General Description.— See general description of Woodland Caribou. Much the same as the Woodland Caribou, but smaller in size with very long, slender horns. Much whiter feet and legs.

Dental Formula.— See dental formula of Woodland Caribou.

Pelage.— Adults: *Summer.* Above, clove-brown mixed with dark reddish and yellowish-browns, underparts and lower side of neck white. *Winter.* Entire coat soiled white.

Measurements.— A little smaller than the Woodland Caribou.

Range.— North of the forest zone in Arctic America in the barren districts.

Food.— Largely moss and twigs of small shrubs.

Remarks.— One of the smallest of the Caribou and living the farthest north. Differing from the other Caribou in the characters given above, it is commonly classified in a distinct group. It has several relatives in this group in North America, besides the European, or Scandinavian Reindeer.

Related Species

Barren-Ground Caribou.— *Rangifer arcticus* (Richardson). Typical form. Barren-Ground region of Arctic America.

Grant's Caribou.—*Rangifer granti* Allen. Size small. A white rump patch. Brow tine much expanded. Barren grounds of Alaska Peninsula.

Greenland Caribou.— *Rangifer groenlandicus* (Gmelin). Size small. Antlers long, slender, with but few points. White ring around eye. Greenland.

This denizen of the treeless, desolate wastes extending from Hudson Bay to Great Slave Lake, and known as the Barren Grounds, is a smaller animal than the Woodland Caribou, and the only deer of this region: hence its name. The front of its head is more cowlike than that of the Woodland species, and its antlers are disproportionately long. They have fewer points than those of the Woodland, and the brow tines incline downward. As a whole they present an armchair appearance. Both the males and the females have horns and shed them annually.

The Barren-Ground Caribou winters in the woods in latitude about 63 to 66 degrees, the bulls going deep into the forests, and the females remaining near their edges. About the end of April they make short excursions from the woods, returning, however, if the weather is frosty. In May the females make their way to the sea-coast, and in the following month are joined by the bulls. In the section immediately east of the Mackenzie River the females leave the timber about March, and the bulls follow in April. The spring journey is made partly on the snow, and, after the snow has disappeared, on the ice that covers the lakes and the rivers. Soon after their arrival at the coast of the Arctic Sea the females drop their young, usually two, although some of the Indians say they have seen females with three fawns. The herds feed on the moist pastures of the valley bottoms

of the coasts and islands until September, when they begin their return journey to the south. The woods are reached in October, the bulls seeking their winter quarters in the deep recesses, and the females remaining on the edges. The bulls do not go so far north as the females, and meet the latter on their return from the coast.

It is difficult to realize the vastness of these migratory herds. Mr. Warburton Pike saw, in 1899, a band of migrating Barren-Ground Caribou that took six days to pass a certain point. He says: "With the increasing depth of the snow there was a noticeable migration of life from the Barren Grounds. Ptarmigan came literally in thousands, while the tracks of Wolves, Wolverines and Arctic Foxes made a continuous network in the snow. Scattered bands of Caribou were almost always in sight from the top of the ridge behind the camp, and increased in numbers till the morning of October 20th, when we were awakened before daylight by the cry of 'La Foule, La Foule!' and even in the lodge we could hear the curious clatter made by a band of traveling Caribou. La Foule had really come and during its passage of six days I was able to realize that an extraordinary number of these animals still roam in the Barren Grounds. From the ridge we had a splendid view of the migration; all the south side of MacKay Lake was alive with moving beasts, while the ice seemed to be dotted all over with black islands, and still away on the north shore, with the aid of the glasses, we could see them coming like regiments on the march. In every direction we could hear the grunting noise that the Caribou always make when traveling; the snow was broken into broad roads, and I found it useless to try to estimate the number that passed within a few miles of our encampment. This passage of the Caribou is the most remarkable thing that I have ever seen in the course of many expeditions among the big game of America. The Buffalo were for the most part killed out before my time, but I cannot believe that herds on the prairies ever surpassed in size La Foule of the Caribou."

At such times the Caribou is an easy prey for the hunter. The Indian's method is very simple. In open country or on the frozen lakes, he will start straight for a band of Caribou, regardless of the direction of the wind. If they run away, he will go back and report that they are wild. Next day he does the same, and probably they are more playful and the slaughter is numerous. Dr. W. T. Hornaday relates that "along the Arctic coast, between Point Barrow and the mouth of the Mackenzie, tens of thousands have been killed by the natives and sold to whaling ships wintering along that coast." In the water the animal is speared by the natives in canoes.

The importance of the Barren-Ground Caribou to the natives can hardly be overestimated. It may safely be said that the animal supplies the staple food and clothing material for three-fourths of Canada's great area. The Indians and Eskimo make tents of hides sewn together; fish-hooks are made from the horns; the skin with the hair on makes the finest clothing to resist the Arctic cold; the flesh is eaten; and the fat, sometimes two or three inches in depth, on the back and rump, which the French-Canadian hunters call *depouillé*, is a valuable article of trade.

By those who have had the most favorable and frequent opportunities of observing it, the Barren-Ground Caribou is regarded as a somewhat stupid animal. It is very inquisitive, and will approach closely any new or strange object, if the latter is only motionless. The Eskimo takes advantage of this weakness. Placing himself behind a rock, he will imitate their hoarse bellow, and in a short time some of them are certain to draw nearer and nearer to the decoy until they pay for their curiosity with their lives.

The animal suffers sometimes from a disease of the hoofs, but this is not often very widespread. Its chief tormentor is the gadfly, the larvae of which sometimes perforate its skin.

Mr. David T. Hanbury says that the migrating Caribou in the Northwest "arrive in bands of from about a dozen to as many as two hundred. Trotting quickly down to the edge of a river they take the water without a moment's hesitation. They swim with marvelous speed, almost appear to be trotting and they keep up a peculiar grunting noise while in the water. The Huskies (Eskimo) wait till they are fairly in mid-stream, then shoot out in their kyaks and surround the band. The spearing then commences. The slaughter is sometimes great.

"The deer show no signs of diminution at present, nor will they so long as the population of the North remains as it is. They exist in hundreds of thousands, it is safe to say millions; and, the few hundreds, perhaps thousands, killed by the Huskies are insignificant."

REINDEER

Rangifer tarandus (*Linnaeus*)

General Description.— See general description of Woodland Caribou. Size smaller than Woodland Caribou, with antlers longer, less palmate and massive. Pasterns short and broad. White ring above hoofs poorly defined.

Dental Formula.— See dental formula of Woodland Caribou.

Pelage.—General body color clove-brown, limbs sooty, sides of neck and long hair on throat whitish, blackish along sides of belly. Nose and face dark. Narrow white band about feet above hoofs in male; in female this band may be wanting.

Measurements.— A little smaller than the Woodland Caribou.

Range.— In North America has been introduced into Alaska and Labrador.

Food.— Same as other Caribou.

Remarks.— By some authorities the Scandinavian Reindeer has been considered nearest to the Woodland Caribou, but the character of the antlers seems to place it with the Barren-Ground species.

By permission of the New York Zoological Society

REINDEER

These handsome animals have been introduced into Alaska from Siberia, and are doing well

This Arctic Deer is of especial interest from the fact that it has long been domesticated and used as a draft animal and beast of burden. In its wild state it is much larger than the domesticated Reindeer. It is found in the sub-Arctic and Arctic regions of Europe and Asia, nearly as far north as the extreme limits of land.

A distinguishing feature of the Reindeer is that both sexes have antlers. These are remarkable for their long, unequally branched horns, and particularly for the fact that of the brow antlers, which are greatly palmated, one is usually aborted and the other hangs over the face. Another noteworthy feature of the Reindeer is its hoof. Just as the camel is enabled by its broad pad to traverse the trackless sands of the desert, so the Reindeer is equipped by nature for traveling over the vast snowfields of the North.

The Reindeer has a brownish coat, dark in summer and lighter in winter, with long, whitish hairs under the neck; the tail is short and goat-like, and the region about it, as also the outlines of the hoof, are nearly white. The hoofs themselves are black.

Of the breeding habits of the wild Reindeer little is known beyond the fact that the fawns are brought forth in the spring.

The Reindeer in its wild state wanders about the treeless mountains and desolate tundras, migrating in immense herds from one feeding-ground to another. Admiral von Wrangel, who witnessed one of these migrations, describes it as extending "further than the eye could reach, a compact mass narrowing to the front. They moved slowly and majestically along, their broad antlers resembling a moving wood of leafless trees. Each body was led by a Deer, a female, of unusual size."

The Reindeer feeds largely on grasses, seaweed and rock lichens. To obtain the last of these it will scrape away several feet of snow with its horns and feet.

Besides flesh and milk for food, the Reindeer furnishes skins for clothing and tents, and its horns and hoofs are also utilized commercially.

The remarkable strength, speed, and endurance of the Reindeer in drawing sledges over the snow are so well known that they need only be referred to here. Pictures of Santa Claus with his Reindeer sledge full of Christmas presents are among the recollections of our earliest childhood.

The interest of Americans in the Reindeer, however, centers in the experiment, made about a quarter of century ago by the United States Government, of introducing Siberian and Lapland Reindeer into Alaska. This experiment has been so remarkably successful as to warrant more than casual mention here.

About the year 1887 the native tribes of northwestern Alaska, owing to their uneconomical habits of living and the loss of food supplies, were in great danger of starvation. The suggestion was made to the United States Government that it would be a useful and humane undertaking for the Government to introduce Reindeer into the territory, and to train the natives in the care and use of them. In 1892, one hundred and seventy-two animals were imported. By 1902 there had been introduced, from Lapland and Siberia, 1720 Reindeer, from which 6116 fawns had been born. On June 30, 1913, the herds had increased to sixty-two, numbering no fewer than 47,266 animals, an increase of 20 per cent. over the previous year. During the year 5000 had been killed for food and skins.

The distribution of the Reindeer to the natives of Alaska is made pro rata. Young natives are required to serve an apprenticeship of four years in the care and management of Reindeer, animals and food being supplied by the Government to such apprentices.

It is estimated that there are in Alaska areas of 400,000 square miles in the aggregate sufficient to feed 10,000,000 Reindeer.

Lapland Reindeer have recently been introduced into Labrador and northern Newfoundland, and the experiment promises great success.

THE ANTELOPE FAMILY

(*Antilocapridæ*)

ANTELOPES, while a family which has many important members in Africa are represented in North America by only one member, the Pronghorn. This unique animal is more nearly akin to the *Bovidae*, or oxen and sheep, than to its foreign brothers. It differs so widely from the foreign Antelope that scientists in despair have created for it a separate family which it occupies alone and undisturbed. The more important points of difference are: the horn is pronged, or branched, and is rooted very close to and above the eye; the horn, while a true one grown around a bony core, and not an antler, is shed and renewed every year; the pelage consists of very coarse, brittle hairs, those on the rump being erectile like the bristles of a wild boar, and stiffen up at the first sign of danger; there are no accessory hoofs; and the marking is strikingly individual. The protective coloration, while generally good, is disturbed by the conspicuous white patch around the tail, which shows most plainly when the animal is in flight.

PRONGHORNED ANTELOPE

Antilocapra americana (*Ord*)

Other Names.— Pronghorn, Prongbuck, Antelope.

General Description.—Form deer-like. The male slightly larger than female, standing about 3 feet at shoulder. Both sexes horned, but female sometimes hornless, and horns of male invariably larger. Horns unique, being flattened, branched, elongate sheaths upon an unbranched bony core. Horns shed annually; core permanent and situated just above orbit. But two hoofs on each foot, accessory hoofs wanting. Body color tan, with conspicuous white rump patch and two white bands across throat and chest. A thick mane of long hair on neck. Hair everywhere coarse and brittle. Ears long and pointed. Tail short, densely haired above. Numerous cutaneous scent glands on jaw, rump and legs. Horns and hoofs black.

Dental Formula.—Incisors, $\frac{0-0}{3-3}$; Canines, $\frac{0-0}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3} = 32$.

Pelage.— ADULTS: Sexes similar. Upper parts and sides rich tan. Entire under parts white. A large area on rump, inside of limbs, sides of face, lips and chin, white. Two white crescentic bands on throat, and white areas on inner surfaces and bases of ears. Mane russet tipped with black. Ears lightly edged and tipped with black. A black spot in male only, on side of head at angle of jaw, and a black area from end of nose to between ears. Tail white. Summer pelage differs from winter pelage principally in having more black markings, mainly on head. YOUNG: Paler than adults.

Measurements.— Length, male, 4 feet; tail 7 inches; height at shoulder 3 feet; horns about 11 or 12 inches in length. Weight, 120 pounds. Female smaller.

Range.— Formerly throughout plains country from 53° latitude south to Mexico, from the valley of the Missouri to the Pacific. Now, range is restricted principally to strip extending along Rocky Mountain area.

Food.— Grass, sage and herbaceous plants.

Remarks.— The Pronghorn is the sole representative of a family that combines characters of a number of widely separate families. It presents peculiarities of the Giraffes, the Goats, the African Antelopes and the Deer. It has no close relative on any other continent. But two forms of the Pronghorn are found in the United States.

RELATED SPECIES

American Pronghorn.— *Antilocapra americana americana* (Ord.) Typical form. Greater part of the Rocky Mountain and Great Plains area from Mexico to 53° latitude.

Mexican Pronghorn.— *Antilocapra americana mexicana* Merriam. With black of head replaced by brown. Southern United States along Mexican border.

The American Pronghorn, known also as the "Prongbuck," "Pronghorned Antelope," or, simply, "Antelope," has the distinction of being the sole representative of a family, this unique position being due to certain characteristics among which are the following: It is the only animal that has a hollow horn that is branched or bifurcated. While the hollow horns of other animals are persistent, those of the Pronghorn are shed and renewed annually. Hunters had

long known this, but for many years the naturalists, including Audubon himself, would not accept the fact. Its feet have no lateral hoofs, or dewhoofs. It has no gland below the eye, nor any tufts of hair on the knees. It can erect the white hairs on its rump, and when the animal is in fighting mood, they instantly bristle up.

The Pronghorn is strictly a North American animal, and is the most graceful and the fleetest of all our quadrupeds. Until within the past few years it has been extensively slaughtered, and, but for the timely legal protection afforded it by all the States within whose boundaries it is still found, it must in the course of a comparatively short period have suffered complete extermination. The Pronghorn first became known to scientists through a specimen brought back by Lewis and Clark from their expedition. Its range originally extended from the Mississippi River to the Pacific Ocean, northward into Canada, and southward into Mexico. At the present day only a few small, widely scattered herds exist, in California, Oregon, Utah, Idaho, Nevada, New Mexico, Texas, Kansas, Colorado, Wyoming and Montana; from the extreme easterly and westerly limits of its former range it has disappeared entirely.

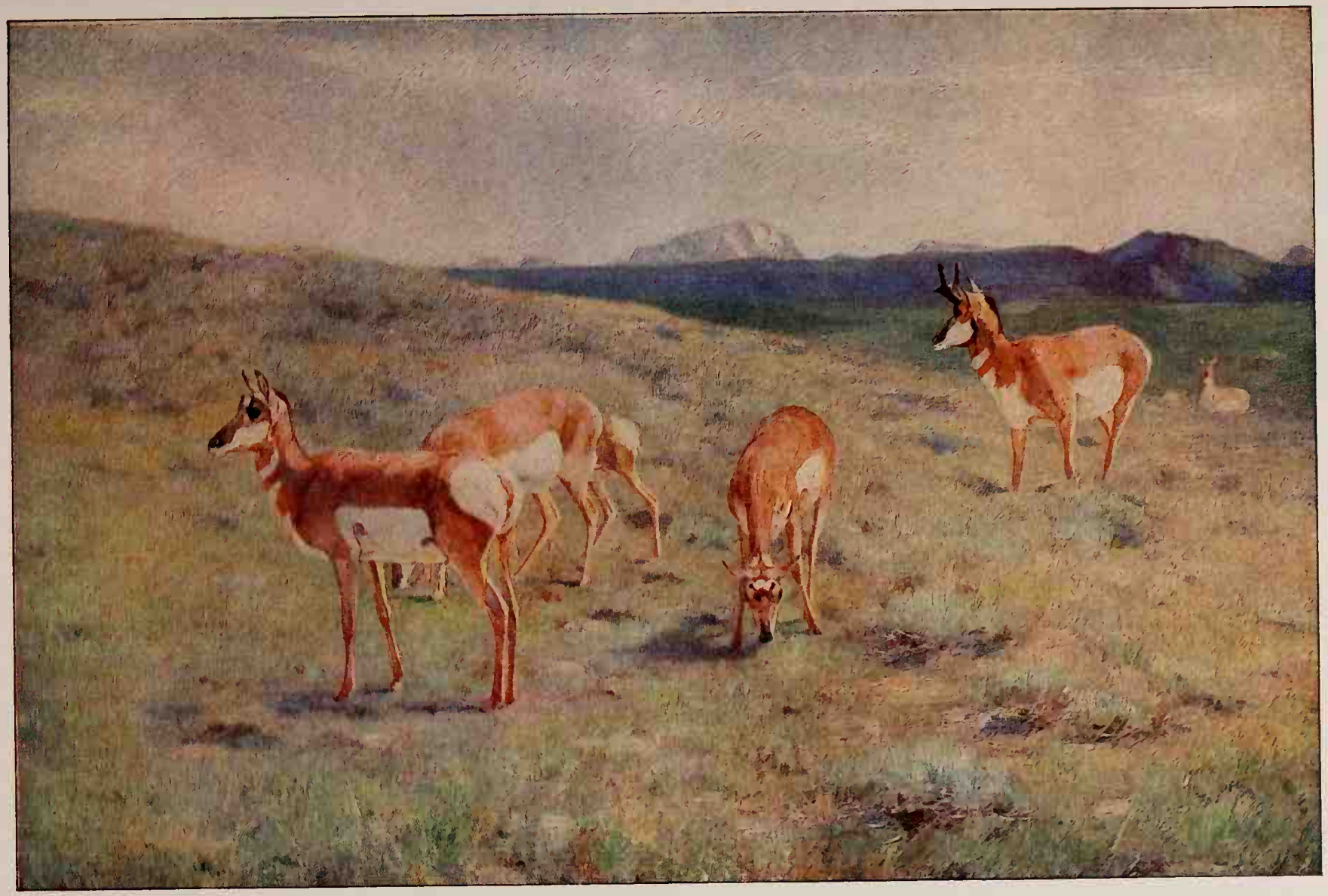
In its wild state, the Pronghorn normally prefers a barren rolling country or naked plains, and avoids timber and broken ground; it has, however, been killed occasionally in places miles away from the nearest plains, and in recent years has been known to bring up its young in rough, hilly country. It avoids forests, and has no liking for high, bare mountains.

The Pronghorn is smaller than the northern Virginia Deer, but is more compactly built. The animal has a fuller muzzle than the Deer; its eye, nearly as large as that of the Elephant, is intensely black; and the expression, like that of the Gazelle, is soft and gentle. The ears,

Photograph by E. R. Warren

PRONGHORNED ANTELOPE

A graceful, fleet-footed animal that has no relatives in America, but occupies a family by itself

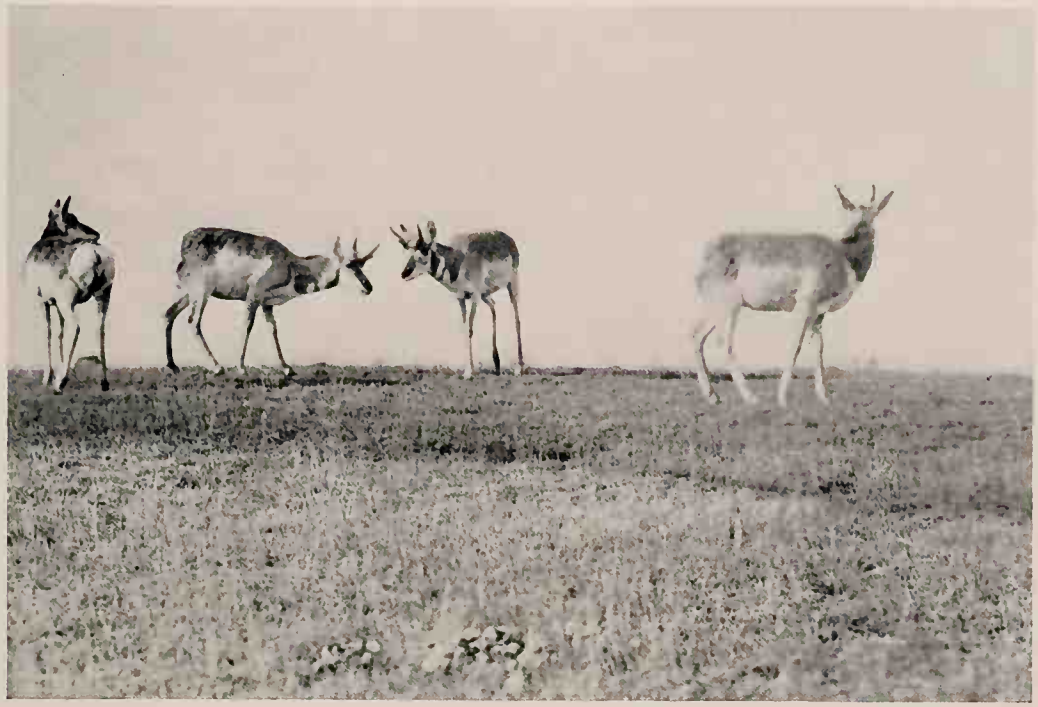


From a painting by Carl Rungius

PRONGHORNS AT HOME

A characteristic group of these peculiar animals, showing their bizarre coloration.

five inches long and three inches broad, and sharply pointed at the extremities, are covered with hair, both within and without. The earlier statement, that the female has no horns, is at variance with the observation of the animal by Dr. Caton, who says: "The horn of the female cannot be detected on the kid, on the yearling it can easily be felt; later I have found them half an inch long . . . and it is only on the fully adult female that the horn appears above the hair. I have never met one more than one inch long, but others have found them three inches long." In an average-sized buck the horns are usually about twelve inches long (an exceptionally large pair measured seventeen inches), with width of twelve and one-half inches between the tips, and are situated directly over the eyes. At the tips they are curved backward a little, and they have a short forward branch or prong.



ANTELOPES AT HOME

The most picturesque and the fleetest of all our North American quadrupeds

The coloration of the Pronghorn renders it a very conspicuous object in the landscape. It is a striking combination of russet, white and black (see details above). The tail is white with just a few tawny hairs on the top.

In several of its characteristics the Pronghorn differs materially from the Deer. It does not skulk or attempt to elude observation. Colonel Roosevelt, who hunted the animal for several years, says: "Its sole aim is to be able to see its enemies, and it cares nothing whatever about its enemies seeing it." When lying down for their noonday siesta, Pronghorns will even "choose a somewhat conspicuous station and trust to their own powers of observation, exactly as they do when feeding." Its powers of sight are much greater than those of the Deer, and it seems to divine intuitively the intentions of the hunter. On this point Mr. Arthur W. du Bray says he entirely agrees with the following dictum of one of his old guides: "What a live Antelope don't see between dawn and dark isn't visible from his standpoint; and while you're a gawking at him thro' that 'ere glass to make out whether he's a rock or a goat, he's a countin' your cartridges and fixin's, and makin' up his mind which way he'll scoot when you disappear in the draw to sneak on 'im — and don't you forget it."

In a wild state, the curiosity of Pronghorns is so great that it often leads them to their destruction. In the old days of the prairie-schooner, the animals, attracted by the white canvas covering of that vehicle, would come so near that

the teamsters shot them at will. James Capen Adams used to decoy them by merely holding up a handkerchief, his coat, or his hat; and he records that "to lie on one's back, with the feet in the air and the rifle between the legs, is a favorite and very successful mode of hunting them."

In spite of its fleetness and of its ability to make, without apparent effort, prodigious horizontal leaps, it seems unable to leap over an object a yard in height. Dr. Caton attributes this inability to the fact that, living on the plains, "they and their ancestors for untold generations have had no occasion to overleap high obstructions, and thus from disuse they do not know how to do so, and never attempt it when they do meet them."

The Pronghorn is a grazing animal, a vegetarian, and a delicate feeder. When wild, it lives largely on grasses, and is especially fond of the tender green blades that come up after an area has been burned over. It drinks once a day, and will travel long distances to some little watercourse. In captivity, it will eat apples sparingly, bread and cake if fresh and good, and the heads of timothy hay. It is fond of common salt.

The migratory habits of the Pronghorn vary with the locality. In some parts of its range it will travel in numbers for great distances each spring and fall; in others the migrations are quite local; while in still other parts it does not migrate at all, remaining on the great plains throughout the year.

Pairing begins in September, and from then till the following March bucks, does, and fawns keep together in herds from which the does withdraw themselves one by one to give birth to their young. There are generally two fawns at a birth, and, when wild, they can run when only a few days old, thenceforward accompanying their mother everywhere.

Chasing the Pronghorn has long been a favorite sport. Besides its inordinate curiosity, to which reference has already been made, the animal has a peculiarity of which hunters are not slow to take advantage: when it has decided to make for a certain point, it is strongly disinclined to abandon its course. It is hunted by stalking and by coursing with greyhounds. The Pronghorn has wonderful vitality, and is credited with being able, when wounded, to carry off more lead than any other animal of its size. If hit anywhere except in a vital spot, "it can still outrun any ordinary horse — even on three legs." Its flesh is excellent, but its coat is of little value, the hair being very brittle.

Besides the inevitable hunter, the Pronghorn finds enemies in the Coyote, the Wolf, and the Cougar, and eagles have been known to carry off fawns. It seems tolerably certain, too, that, owing to the exposed nature of many of the Pronghorn's haunts, blizzards, and unduly severe winters must claim a great many victims.

The Pronghorn is readily tamed and soon learns to enjoy the society of man. A neighbor of Colonel Roosevelt had three fawns that had been fostered by a sheep, and which followed him about so closely that he had to be always on the lookout to see that he did not injure them; and Dr. Caton had one which "assumed he had as much right in the kitchen as any of the domestics, and, if he found the doors open, he enjoyed a visit to the parlor, and especially a siesta on the lounge in the library."

Mr. Merritt Cary, in "A Biological Survey of Colorado," says that this most graceful game animal seems doomed to early extinction in many sections despite the protection afforded by the law. The decrease of Antelope in Colorado during the past few years has been great. In 1898 the State game warden placed the number at 25,000, while in 1908 the game commissioner estimated not over 2000. A conservative estimate based on data collected by the Biological Survey would be not over 1200 in this State.

THE OXEN, SHEEP, AND GOAT FAMILY

(*Bovidæ*)

ONE of the most important families of the entire animal kingdon is the *Bovidæ*. Its economic value to man, in both its wild and domesticated states, is incalculable. There are some fifty leading species, such as Bison, Buffalo, Mountain Sheep, Goats, Musk-ox and Ibex, found in every continent except Australia and South America. In our own country we have some of the finest specimens of the family, although the numbers have sadly dwindled before the relentless war of extermination which has been waged. The Bison, or Buffalo, is a striking example of this. A few decades ago it roamed the western plains in countless thousands. By the end of the century only heroic efforts on the part of the Government and the establishment of a few private parks saved it from perishing entirely.

The Hollow-horned Ruminants, or *Bovidae*, are distinguished from their allies by the presence of true horns; that is to say, of hollow and unbranched sheaths of horn growing upon bony protuberances, or cores, arising from the frontal bones of the skull, neither horny sheaths nor the bony cores being shed at any period of existence. In all existing wild species these horns are present at least in the male sex; but in many domesticated races of cattle, sheep, and goats, they are absent in both sexes; and the same holds good for certain extinct members of the family. Usually the molar teeth of the Hollow-horned Ruminants are characterised by the great relative height of their crowns, and in all cases there is no tusk or canine tooth in the upper jaw. In some few instances the small lateral toes may be completely absent, but they are generally represented merely by the small spurious hooflets alone, which may be supported internally by minute and irregularly-shaped nodules of bone. The Hollow-horned Ruminants are chiefly Old World forms, although they are represented in North America by the Musk-ox, the American Bison, the Rocky Mountain Goat, and the Bighorn Sheep. They are unknown in South America.

AMERICAN BISON, OR BUFFALO

Bison bison (*Linnaeus*)

General Description.— A large wild ox, horned in both sexes. The horns are curved and cylindrical, and grow annually but are never shed. Two main hoofs, two accessory hoofs, on each foot. Stomach complex; chews cud. Spines of dorsal vertebrae very high producing great hump. Tail short, covered with short hair, but tuft of long hair on end. Hair long and woolly especially on head and fore parts. Thick beard present. Color dark brown. Horns, hoofs and muzzle black.

Dental Formula.—Incisors, $\frac{0-0}{4-4}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3}$=32.

Pelage.— ADULTS: Sexes much the same, with cow a trifle darker in body color. Head, neck, chest, and shoulders blackish-brown to black. Elsewhere pale, grading to cinnamon on rump. Hair long and shaggy; an undercoat of finer wool-like hair. A long beard upon the chin, and thick tufts of longer hair upon crown, about base of horns and down forelimbs about to accessory hoofs. Hair much shorter on area beginning just back of fore limbs and taking in hind quarters. YOUNG: At birth, dull reddish-yellow, paler on under parts. At six months, assumes more the adult appearance; by end of second year, everywhere deep glossy blackish-brown. Pales with age.

Measurements.— Length, male, 10 to 11 feet; height at shoulder, 5 to 6 feet; length of tail, 15 inches. Horns 20 inches long by 15 inches girth at base. Weight 1800 to 2100 pounds. Female, height at shoulder 4½ to 5 feet; weight 700 to 1200 pounds.

Range.— Historic range from Great Lakes to the Rockies, and from Northern Mexico to 60° latitude. By 1870 restricted to a strip north and south along Great Plains and eastern Rockies; by 1880 found only in area formed by North Dakota, Montana and Wyoming with a few in Texas and in Canada. Now extinct in the wild state, and known only from zoological herds and animals on reservations.

Food.— Grasses of the plains.

By permission of the New York Zoological Society

MONARCH OF THE HERD

A fine specimen of the Bull Bison, or Buffalo, showing his shaggy winter coat

Remarks.—The Bison is the only wild ox, with the exception of the Musk-Ox, found in North America. There is no animal with which it may be confused although the term Buffalo, through its common use for oxen of the Old World, is not a happy name for the Bison. There is but one species of Bison, which contains two sub-species.

RELATED FORMS

American Bison.—*Bison bison bison* (Linnaeus). The typical form.

Woodland Bison.—*Bison bison athabascae* Rhoads. Larger and darker than the typical Bison with longer, more slender horns. Found formerly in the wooded uplands from Great Slave Lake south probably to the United States. Known now only from a few survivors along the Great Slave River.

Because of its northern distribution this animal did not come so much into contact with white men and civilization, but rather with Hudson Bay trappers and Indians. Its habits and characteristics were much the same as those of its southern relative.

The American Bison has long been popularly, through erroneously, known as the Buffalo, and the two terms will be used synonymously here. For the benefit of the non-naturalist it may be explained that a true Buffalo has no hump over its shoulders. Such an animal is the Water Buffalo of India, or the Carabao of the Philippine Islands. The American Buffalo has a considerable hump, and is a Bison. It is a large, massive animal, a fine adult bull measuring eleven feet from nose to root of tail, and five to six feet in height at the shoulders. Its average weight is about 1800 pounds, but a large specimen has weighed as much as 2190 pounds; the females are considerably smaller than the males. Its horns are sometimes twenty-two inches in length, with a girth of sixteen and three-eighths inches at the base, and a spread of thirty-five inches from tip to tip. In yearlings, the horns are four to six inches long. Until four years old, the young males are called "spike-bulls," and their horns are jet black. In the adult, they become grayish. The forequarters are very heavy and covered with dense hair, and the tail has a terminal tassel.

The upper part of the body and the hind quarters are of a pale gray-brown; the lower parts, dark brown. The hump is covered with a dense mass of yellow-brown hair; the head, under part of the neck, and the forelegs as far as the knees bear a covering of shaggy hair shading from dark brown above into black below. The body color of the cow is darker. The coat of the Bison is at its best in November and December. By March it has become weather-beaten and shabby, and shedding begins. For the next three months the old coat hangs in rags, and the animal presents a most dilapidated appearance.

Naturally among the millions of individual Buffaloes a few years ago, the hide, or "robe," as it was termed, exhibited many color varieties. Thus there were black, blue, beaver, buckskin, and white or pied robes. The last-mentioned were considered the rarest. The great Cheyenne chief Roman Nose had a magnificent pure white robe, which he called his "great medicine," and which he was wearing when he fell before Forsyth's troops.

It seems pretty well established that the Bison is polygamous, the observations of Audubon and Bachman to the contrary notwithstanding. The breeding season is from June to September. The cow does not breed till her third year. The combined bellowing, or "roaring" as it is called, of the bulls in the breeding time can be heard for miles. The calves (usually one, sometimes twins) are born about May or June. In their wild state, during the few first days of their life they were formerly subject to the depredations of the Coyote and Gray, or Buffalo Wolf. Against one or two of these the cow could successfully defend her offspring, but if the assailants were numerous she would bellow to the bulls for assistance. These would quickly respond and would stand in a circle around the calf, while the wolves "at some twelve or fifteen paces distant sat licking their chops in impatient expectancy." An incident of this nature was witnessed by an army surgeon, as related in "Plains of the Great West." The doctor determined to watch the performance. After a few moments the knot broke up, and, still keeping in a compact mass, started on a trot for the main herd, some half a mile off. To his very great astonishment, the doctor now saw that the central and controlling figure of this mass was a poor little calf, so newly born as scarcely to be able to walk. After going fifty to one hundred paces the calf lay down, the bulls disposed themselves in a circle as before, and the wolves who had trotted along on each side of their retreating supper, sat down and licked their chops again; and so, though the doctor did not see the finale, it being late and the camp distant, he had no doubt that the noble fathers did their whole duty by their offspring, and carried it safely to the herd. In less than a week from their birth the calves are strong

enough to run with the herd, and their safety is then assured.

The cow Bison is not always the most solicitous of mothers as regards her little one's safety. Mr. Ernest Thompson Seton states that a cowpuncher some years ago "often amused himself by roping the calves. When one was caught, he would jump off, remove the lasso, and hold it with his hands. The mother would stand at a distance of 100 yards gazing anxiously, neither cow nor calf making any sound. As soon as he let the calf go, the mother, seeing it was free, knew it would take care of itself, and, turning tail, went off at full gallop, without even looking behind."

As the Bison shed their coats, leaving much of their hinder parts naked, they suffered much from the attacks of mosquitoes and from the prickly seeds of the spear grass. The huge animals availed themselves of any convenient boulder or the trunks of trees against which to rub themselves, in their desire to gain relief from their insect scourges. The early telegraph poles over the plains were frequently thrown down by the Buffaloes rubbing against them. Another remedy employed was the wallow of water and mud.

During the latter part of the breeding season the animals of all ages and both sexes have intermixed in the herd. After September the males become indifferent to their partners, and separate themselves into one herd and the females into another. As early as 1542, Coronado and his followers were "much surprised at sometimes meeting innumerable herds of bulls without a single cow, and other herds of cows without bulls."

There has been some difference of opinion with regard to the Buffalo and migration. Catlin says: "These animals are, truly speaking, gregarious but not migratory;" and there are to be considered the undoubted facts that the line of march was not always the same, that in certain cases the movements of the herds were not prompted by the necessity of seeking fresh pasturage, and that herds were found winter and summer over certain parts of the animals' range. But, whether from choice or from necessity, vast numbers of Buffaloes, sometimes reaching into the millions, moved northward three or four hundred miles in the spring, and southward in the fall, and this habit is known to have existed for a hundred years. As Seton says: "Theoretically, the Buffalo must have been migratory.

GETTING READY FOR SUMMER

The Bison shed their shaggy coats with the approach of spring, and do not don them again until well into the fall

Although it covered a vast region, it continued of one species, whereas, it would probably have split up into several distinct species had it not been continually mixed as the result of migrations."

Reference has already been made to the attacks of Gray Wolves on Buffalo calves. Weak and old Buffaloes also fell victims to these beasts of prey. Still the total number destroyed by them cannot have been very great. Far more terrible enemies were the prairie fires, quicksands, and treacherous ice on the rivers which, combined, were responsible for the death of enormous numbers of Buffaloes. In 1867, more than 2000 out of a herd of some 4000 were engulfed in a quicksand on the Platte river. Prairie fires destroyed whole herds. Alexander Henry, in his "Journal," under date of November 25, 1804, records: "At sunset we arrived at the Indian camp, having made an extraordinary day's ride, and seen an incredible number of dead and dying, blind, lame, singed, and roasted Buffalo." Treacherous ice on the rivers took greater toll of Buffalo life than any other natural enemy of the animal. Under date of May 2, 1807, Henry records: "The number of Buffalo lying along the beach and on the banks passes all imagination. They form one continuous line and emit a horrible stench. I am informed that every spring it is about the same." John McDonnell, in his "Journal," states: "Observing a good many carcasses of Buffalo in the river and along the banks, I was taken up the whole day in counting them, and, to my surprise, found I had numbered when we put up at night, 7360 drowned and mired along the river and in it." The yearly flood on the Missouri river "bore countless Buffalo hulks to be packed away in the Mississippi mud, that in some far geological day will be the rock, all stored with unnumbered bones." Rotten ice on all the northern rivers, totalling in length about 20,000 miles, must also have caused the death of enormous numbers of Buffaloes.

A further natural enemy of the Buffalo was, in the opinion of Mr. Seton, the blizzard. "The great herds that went north in 1870–1 never returned. There is no evidence that any large numbers of them were killed by hunters, red or white, and there is, therefore, but one reasonable explanation of their disappearance. They were exterminated by the blizzards of 1872. Further, I believe that, all times, the Dakota blizzard has taken heavier toll of the Buffalo than even the Dakota Indian did."

It is interesting to note that besides all these enemies the Buffalo had one little companion and friend — the cowbird or Buffalo bird. "Sometimes the cowbirds walk sedately behind their grazing monster; sometimes they flit over, snapping at flies; often they sit along the ridge-pole of his spine." In the winter of 1900–01 in the herd at Silver Heights, near Winnipeg, a cowbird "remained with the Buffalo, especially with the biggest bull of the herd. Its food was of the Buffalo's food; by day, it flitted near or warmed its toes in the wool of the animal's back, by night it snuggled on a sort of hollow it had made in the wool just behind his horns."

The Buffalo unmolested attains to a ripe old age. Colonel Jones relates that he has frequently seen wild Buffaloes so old that their horns had decayed and dropped off.

In domestication the Buffalo breeds freely, and it has been crossed with the domestic cow.

The economic value of the Buffalo has been great. Its flesh has sustained thousands of red men and white; its hide, tongue, and horns have been regular articles of commerce. Mounted heads have fetched $400 or more.

No one who has not seen a wide plain covered by Buffalo can gain any idea of their countless numbers, only a very few years ago. Here are the impressions of one eye-witness, Col. R. I. Dodge, who in 1871 saw one of the immense herds while traveling in Arkansas. For twenty-five miles he passed through a continuous herd of Buffalo. "The whole country appeared one great mass of Buffalo, moving slowly to the northward; and it was only when actually among them that it could be ascertained that the apparently solid mass was an agglomeration of innumerable small herds of from fifty to two hundred animals, separated from the surrounding herds by greater or less space, but still separated. The herds in the valley sullenly got out of my way, and turning, stared stupidly at me, sometimes at only a few yards' distance. When I had reached a point where the hills were no longer more than a mile from the road, the Buffalo on the hills seeing an unusual object in their rear, turned, stared an instant, then started at full speed directly toward me, stampeding and bringing with them the numberless herds through which they passed, and pouring down on me all the herds, no longer separated, but one immense compact mass of plunging animals mad with fright, and as irresistible as an avalanche. Reining in my horse I waited until the front of the

mass was within fifty yards, when a few well-directed shots split the herd, and sent it pouring off in two streams to the right and left. When all had passed they stopped, apparently perfectly satisfied, many within less than 100 yards. From the top of Pawnee Rock I could see from six to ten miles in almost every direction. This whole vast space was covered with Buffalo, looking at a distance like a compact mass."

The history of the Buffalo and its practical extermination as a wild animal reads like a tragedy. It has been so often recounted that only a few salient facts need be mentioned here. It is safe to put the primitive number of Buffalo at 50,000,000 to 60,000,000; in 1850, there were probably remaining 20,000,000; in 1870, only 5,500,000 were left; in 1888 (including some in captivity), a meagre 1,300; and about 1895 the remnant had probably dwindled to 800. To-day, thanks to the efforts of the governments of the United States and Canada, the New York Zoological Society, the American Bison Society, and certain public-spirited individuals, the Bison is breeding rapidly in parks and private preserves. In 1912 it was estimated that there were in North America 2,907 living Bison, and since then the increase has continued, several small herds being in a thriving condition.

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THE LAST OF MANY MILLIONS

The Wichita herd of Bison is one of the few groups being carefully preserved

MUSK-OX

Ovibos moschatus *(Zimm.)*

General Description.— A somewhat small wild ox standing about 50 inches at withers. Both sexes horned, horns of male, however, much the larger. Horns never shed, rough and grooved at base, bending abruptly downward from occiput where they nearly meet in midline, tip curving upward and forward but not passing above level of eye. Horns blackish at tip. Neck short. Muzzle hairy, with small triangular naked space between nostrils. No facial glands. Tail rudimentary. Hoofs broad, asymmetrical, with large lateral hoofs. Pelage long, shaggy. Color dark brown, except for saddle-shaped patch of yellowish on mid-back. Hair very long and moderately soft. A dense woolly undercoat of soft hair.

Dental Formula.—Incisors, $\frac{0-0}{4-4}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3}=32$.

Pelage.— Adults: No marked seasonal change except that the shed underfur in summer gives animal patchy appearance. Sexes alike. Everywhere dark brown with head, neck and sides of body tending to blackish in adult males. A saddle-shaped patch of yellowish-white over lumbar region. Feet whitish. Young: Very much as adults.

Measurements.— Length, male, 6 to 6½ feet; height at shoulder, 4 to 4½ feet. Horns, along outer curve 22 to 30 inches; width at base, 9 to 12 inches; tip to tip, 15 to 25 inches. Weight, 400 pounds. Female, slightly smaller throughout; horns decidedly smaller, not so wide or ridged at base.

Range.— Arctic America from Mackenzie River and north of 60th parallel, south to Melville Bay.

Food.— Grasses, moss and lichens.

Remarks.— A sturdy wild ox well adapted to Arctic life by the possession of a dense coat of long hair, wide hoofs to bear it upon snow, and a faculty of subsisting on a scanty diet of moss and lichens when everything is covered by snow.

Related Species

Common Musk-Ox.— *Ovibos moschatus moschatus* (Zimmermann). The typical form. Arctic America from west side Hudson Bay to Banks Land.

Melville Island Musk-Ox.— *Ovibos moschatus melvillensis* Kowarzik. Melville Island.

Hudson Bay Musk-Ox.— *Ovibos moschatus niphoecus* Elliot. Blacker in color, horns lighter, little white on head. Region to the northwest of Hudson Bay.

Ward's Musk-Ox, or White-faced Musk-Ox.— *Ovibos moschatus wardi* Lydekker. White space between horns and on face, also generally whitish on sides of head. More white on feet. General color lighter. Eastern Greenland.

Photograph from the American Museum of Natural History

MUSK-OX

Living in the snow-clad wastes of the Arctic Circle, it is hard to see how this animal maintains life, where the vegetation is scanty and hidden

The Canadian Barren Grounds, a stretch of country extending westward from Hudson's Bay to the Mackenzie river, are among the most desolate regions on the face of the earth. Even in the continuous sunshine of the short summer, ice is to be found in the lakes till the month of July; and it frequently happens that the young of the water-fowl are frozen into the early autumn ice before they are strong enough to fly, and ripe berries are covered by the snow before they can fall. In this inhospitable territory, year in, year out, dwells the Musk-Ox, neither true Ox nor true Sheep, yet partaking of the characteristics of both. In prehistoric times, the range of this animal was a very extensive one. Professor Henry F. Osborn records the finding of fossilized bones of the true Musk-Ox or of extinct species in Eschscholtz Bay, Alaska, and as far south as Kentucky; while in the Old World the animal roamed over northern Asia, and in Europe remains have been found as far south as France and Germany.

The Musk-Ox is an odd-looking animal, and has been not inappropriately described as resembling a huge hairy ram, its remarkable horns contributing largely to this similarity; but its stout and short legs give it the appearance also of a small Ox. It stands about four and one-half feet high, and has a length of about six and one-half feet. The head is massive, especially in the older males. The pupils of the eyes are bluish-purple and elongated, and the iris brown; and the ears are so short that, like the tail, they are concealed by the animal's long hair. The hoofs are peculiar, the inner half of each being pointed while the outer half is rounded. Its hairy coat is warmer than that of any other mammal, and consists of an outer covering of coarse hair, which curls and is matted on the back, but elsewhere is more than a foot long, and conceals the upper half of the legs. Next the skin is a growth of fine wool, so dense as to be impervious to moisture. But the most noteworthy peculiarity of the Musk-Ox is its horns, which grow at first in a horizontal direction. The downward bend does not appear till the second year, and the horns are not fully grown till the sixth or eighth year. The horns of the bull grow into an almost solid boss on the top of the head.

The food of the Common Musk-Ox consists for most of the year of mosses, to obtain which it scrapes away the snow with its hoofs. The Greenland species has been seen to use its horns also for this purpose. In summer, according to Mr. Warburton Pike, it " feeds exclusively on willow leaves, which appear to give a great amount of nourishment." The fat accumulated by the animal in the summer serves also to nourish it during the long winter.

Mating begins in September, and the calves, usually one at a birth, are born in May or early in June. From what Mr. Pike could gather from the Indians, the cows calve only every second year. The big bulls are seen wandering singly in the summer, while the young bulls and the cows keep together in small bands. "Towards autumn the bands increase in size, and it is not uncommon to see forty or fifty animals together at this season of the year."

The specific name of the Musk-Ox is derived from its strong odor. The similarity of this odor to musk has, however, been denied by some hunters; and all who have fed on the animal say that if the carcass is promptly and properly eviscerated there is no taint to the flesh, which is juicy, tender, and excellent eating.

Although the Eskimo hunt the Musk-Ox for its pelage, which they use for bedding as well as an article of barter, the fact that the skins are in their prime in winter, when the difficulties of the chase are greatest, operates to prevent any large reduction in the numbers of the animal; for " failure to find the game must inevitably end in starvation and a desperate retreat with uncertain results." In summer the animals are killed by the Barren Ground Indians for the meat and for the skins which can be used for tanning; otherwise, at this season of the year the latter have no commercial value.

The Musk-Ox is gregarious, and is usually seen in herds numbering from a dozen or so to eighty or a hundred individuals. It has been thought that the animal was migratory; but Mr. Henry Biederbick, of the Greely Arctic Expedition, is of the opinion that the supposition is an erroneous one, at any rate so far as the Greenland species is concerned.

Though the skin of the Musk-Ox has been known since 1670, when the Hudson's Bay Fur Company was founded, it was not until 1899 that a live animal was brought into civilized countries. In that year two calves which had been captured on Clavering Island, off the east coast of Greenland, were bought by the Duke of

Bedford. One of these survived till 1903. The Copenhagen Zoological Garden received a male calf on October 7, 1900. This was fed on "ground oats and wheat bran, with a very little white bread cut in pieces, besides hay (grass in summer) and willow and elm branches throughout the year." At last accounts, the animal was doing well, but attempts to cross it with a Yak Cow and a Frisian Sheep had not met with success.

The killing of a Musk-Ox has saved many a life in the great Arctic wastes. Peary in his great white waste." Further on he says: "A single Musk-Ox when he sees the dogs, will make for the nearest cliff and get his back against it; but a herd of them will round up in the middle of a plain, with tails together and heads toward the enemy. Then the bull leader of the herd will take his place outside the round-up and charge the dogs."

Of this method of combining for defense, Mr. Pike says: "On the only occasion when I have seen them held at bay by dogs there has been absolutely no attempt at regularity of formation,

By permission of the New York Zoological Society

MUSK-OX

A young Bull that is doubtless longing for its own frozen wastes, where it must forage for food, instead of having regular meals handed in on a fork

book, "The North Pole," writes: "For myself, I never associate the idea of sport with Musk-Oxen — too often in the years gone by, the sighting of those black forms has meant the difference between life and death. In 1899, in Independence Bay, the finding of a herd of Musk-Oxen saved the lives of my entire party. On my way back from 87° 6′ in 1906, if we had not found Musk-Oxen on Nares Land, the bones of my party might now be bleaching up there in the and the calves were often to be seen in the forefront of an irregular group." The habit is, however, attested by many competent authorities, among whom Mr. Harry Whitney writes: "On gaining the top of the ridge I found thirteen Musk-Oxen at bay, tails together, heads down, in defensive formation. Two dogs, over-venturesome, had been gored to death." He mentions also the fact that "wounded Musk-Oxen display no signs of pain."

A very circumstantial account of this defensive formation of the Musk-Ox is given in Professor Nourse's "American Exploration in the Ice Zone." As it shows how the native hunters turn it to advantage, it is reproduced here: "When the band was surrounded, and as soon as they perceived that the dogs were slipped, they formed into their usual one circle of defence — a Musk-bull battery of nine solid battering heads and twice the number of sharpened horns. The dogs were quickly at these heads, barking and jumping back and forward. After a few minutes watch of the movements of dog versus bull and bull versus dog, In-nook-pro-zhee-jork went forward to within twelve feet of a large bull, carrying a lance which had a line attached by which he could draw it back; but at his second throw the wounded and infuriated bull made a fearful forward plunge, from the effects of which the hunter and his companions escaped only by a very timely jump to the left. The bull was soon again brought to bay. On-ne-la then pulled trigger on another noble bull of the circle of defence, and Pa-pa shot the one which had been lanced, when at the noise of these guns the whole circle bolted away except two, who stood their ground, side by side, long after the whole fight was ended."

ROCKY MOUNTAIN SHEEP

Ovis cervina *Desmarest*

Other Name.— Bighorn.

General Description.— The Rocky Mountain Bighorn is a large wild sheep reaching a weight of about 350 pounds for the male. Body stout. Nose narrow, chin beardless. Ears small, pointed, hairy. Tail short, pointed. Lateral hoofs present, main hoofs large with spongy cushion. Glands between hoofs and below eyes. Head broadest between eyes. Both sexes horned, the horns of the male much the larger. Horns curving regularly backward, outward and downward, in a majestic spiral sweep. Transverse ridges on horns. Horns never shed. Hair of medium length, rather coarse and brittle. Color grayish-brown with patch of whitish on buttocks and above tail. Horns and hoofs blackish.

Dental Formula.—Incisors, $\frac{0-0}{4-4}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3}$=32.

Pelage.—Adults: Not much seasonal variation. Sexes alike. General body color grayish-brown, darkest along dorsal line. Face ashy-gray, neck grayish-brown tinged with plumbeous. Under parts, buttocks, inside of legs, on each side of base of tail, and upper part of throat whitish. Legs dark grayish-brown. Tail above like back. Young: Pelage much as in adults.

Measurements.—Length, male, 5 feet; height at shoulder, 40 inches; tail, 3 to 5 inches; girth around chest, 4 feet. Horns of male, 40 to 50 inches around curve; circumference at base, 15 to 16 inches. Female smaller.

Range.— High mountain ranges from the Colorado River and Arizona into British Columbia.

Food.— Grass, plants and twigs of shrubs.

Remarks.— The Rocky Mountain Bighorn is found for the most part in rough broken country where his peculiar adaptations enable him to elude his enemies, the soft spongy nature of his hoofs giving him sure footing over the most precipitous places. The Bighorn is protectively colored and in response to his habitat has evolved a variety of color schemes in his pelage according to where he is found. It is largely upon this basis that the different varieties of mountain sheep have been classified.

Related Species

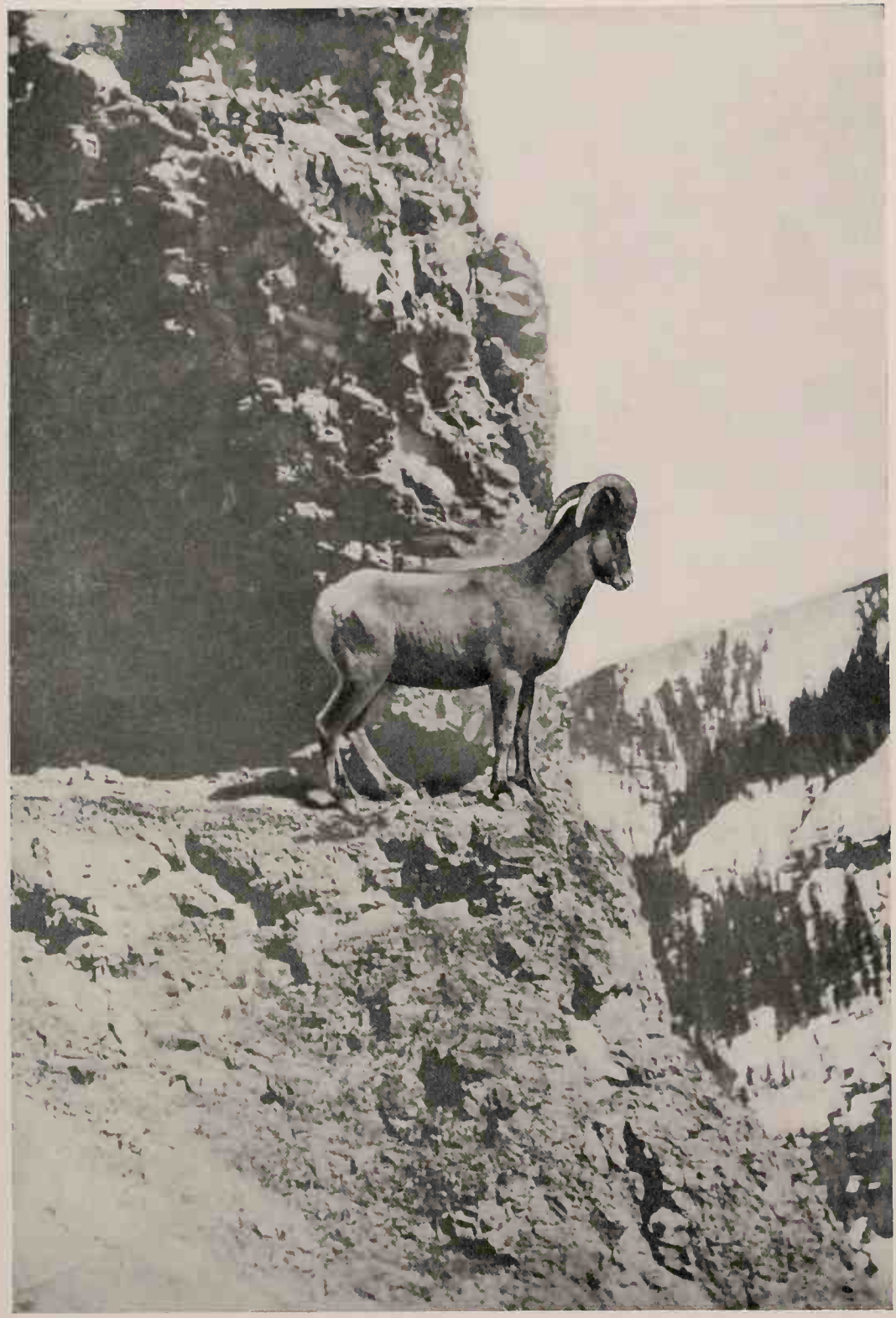
Rocky Mountain Bighorn.— *Ovis cervina cervina* Desmarest. The typical form as described above. Mountain regions from Arizona and Colorado River, north into British Columbia and Alberta.

Audubon Bighorn.— *Ovis cervina auduboni* Merriam. Molar teeth larger, lower jaw heavier and deeper. Bad Lands of South Dakota.

California Bighorn.— *Ovis cervina californiana* (Douglas). Very similar to the typical form. Cascade Mountains of southern Washington and Oregon; Mount Shasta and mountains of northern California; now probably extinct.

Mexican Bighorn.—*Ovis cervina mexicana* Merriam. Much larger ears, horns longer but less massive, paler in color, hoofs larger than the typical form. Texas, New Mexico and Arizona.

Gaillard Bighorn.—*Ovis cervina gaillardi* Mearns. Very small with small feet. Pelage very pale. Rump patch not sharply defined. Arizona.



Photograph by L. A. Myrick

ROCKY MOUNTAIN BIGHORN

In sure footedness and daring the Rocky Mountain Bighorn rivals the Chamois of the Old World. Its native "heath" is well shown in this remarkable photograph

The Bighorn might be called the Chamois of our western mountains, scaling the rugged cliffs and plunging over precipices with the same agility and confidence. The elastic spring of the animal when startled, and the easy poise of the splendid head are exceedingly graceful, and the animal seems built and proportioned to the finest detail for the adventurous life it leads.

During the breeding season an old ram presides over the flock of ewes and lambs, driving the younger rams off by themselves, as is usual among the polygamous animals. The flocks are exceedingly watchful, and at the slightest alarm are off instantly, selecting a course that

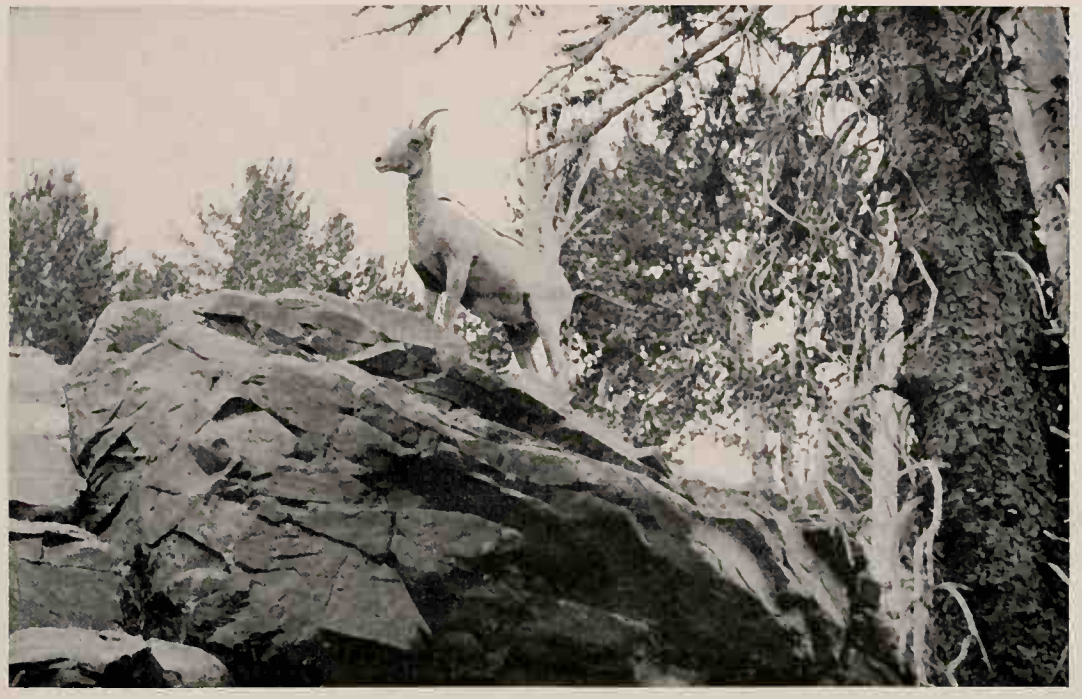
BIGHORNS GRAZING

These Bighorn Sheep have found a grassy slope to their liking

few animals or men care to follow. In early spring the Sheep venture farther down into the mountain valleys in search of food, but soon return to their rocky fastnesses among the higher slopes.

From the edges of the Alaskan glaciers to the dry, waterless crags of the Mexican Sierras we find one species or other of the Mountain Sheep. In the "Bad Lands," the easternmost part of their range, Audubon made the acquaintance of these noble animals in 1843. He says: "The parts of the country usually chosen by the Sheep for their pastures are the most extraordinarily broken and precipitous clay hills or stony eminences that exist in the wild regions belonging to the Rocky Mountain chain. Perhaps some idea of the country they inhabit — which is called by the French Canadians and hunters 'mauvaise terres,' may be formed by imagining some hundred of loaves of sugar of different sizes, irregularly broken and truncated at top, placed somewhat apart, and magnifying them into hills of considerable size. Over these hills and ravines the Rocky Mountain Sheep bound up and down, and you may estimate the difficulty of approaching them and conceive the great activity and sure-footedness of this species. They form paths around these irregular clay cones that are at times six to eight hundred feet high, and in some situations are even fifteen hundred feet or more above the adjacent prairies; and along these they run at full speed, while to the eye of the spectator below, these tracks do not appear to be more than a few inches wide, although they are generally from a foot to eighteen inches in breadth. In many places columns or piles of clay or hardened earth are to be seen eight or ten feet above the adjacent surface, covered or coped with a slaty, flat rock, thus resembling gigantic toadstools, and upon these singular places the Bighorns are frequently seen, gazing at the hunter who is winding about far below, looking like so many statues on their elevated pedestals. One cannot imagine how these animals reach these curious places, especially on these inaccessible points, beyond the reach of their greatest enemies, the Wolves, which prey upon them whenever they stray into the plains below."

Generally speaking, the range of the Bighorn extends from the northern States of old Mexico to northern British Columbia, and from the eastern base of the Rocky Mountains to the Pacific Coast. There are many mountain ranges, however, within these limits, in which it has never been found. In Alaska it is replaced by the White Sheep (*Ovis dalli*), and in the Cassiar Mountains by the Black Sheep (*Ovis stonei*). This animal has few characteristics in common with the domestic Sheep. The horns of the wild ram resemble somewhat those of the domestic species, although more massive.



BIGHORN EWE

As it takes its observation from a spur of rock, this mountain ewe completes an ideal study for a sculptor

The wild ewe has horns from six to eight inches long that curve backward, whereas the domestic ewe has none.

The lofty crags of the Rocky Mountain National Park are the natural home of the Bighorn. This animal is much larger than any domestic Sheep. It is powerful and wonderfully agile. When pursued these Sheep, even the lambs, unhesitatingly leap off precipitous cliffs. Of course, they strike friendly ledges every few feet to break the fall, but these ledges often are not wide enough to stand upon; they are mere rocky excrescences a foot or less in width, from which the Sheep plunge to the next and the next, and so on till they reach good footing in the valley below. So swift is the descent that, seen from below at a distance, these pauses are often scarcely apparent.

"The Bighorn," says Singer, "is one of the wildest, shyest and most difficult to hunt, successfully, of all American game animals. His habitat being the highest, roughest and most forbidding mountain ranges, it is only by the most arduous toil, wearisome and in many cases dangerous climbing, that the hunter can reach the home of the Sheep at all. After one has toiled for hours he will be fortunate if a capricious current of wind, so often fatal to the success of mountain hunters, does not sweep round in a direction exactly opposite to that from which it has been blowing, and carry the scent of the hunter to the keen nostrils of the quarry."

Persistent killing has largely reduced its numbers. An estimate, made only a few years ago, gave the following figures: Arizona, a few, very widely scattered, small bands; Colorado (after twenty-five years' unbroken protection), 3500; Utah, probably quite extinct; Wyoming, 100; Yellowstone National Park, 210 head, "safe and sound and slowly increasing;" Glacier Park, 700; Idaho, a remnant of, say 200; Montana, 100; Alberta and British Columbia, some fine herds and three preserves in which they are

protected. In a large number of States the killing of Bighorn is now prohibited, but there is great difficulty in enforcing the game laws.

The Bighorn is a stoutly built animal, larger than the domestic Sheep, the ram standing about three and one-half feet high at the withers, and weighing about 300 pounds. A very fine ram, killed in Wyoming in 1889, measured fifty-eight inches from nose to root of tail, and had a

Photograph by Max Wilde

A SUSPICIOUS BIGHORN

While the Mountain Sheep are very shy and their protective coloring makes them hard to distinguish, the ewes may be found more frequently than the rams, as the former do most of their browsing during the day

height at the shoulders of forty inches. The tail was three inches long. The Bighorn has a heavy coat of coarse, stiff hair, resembling that of the Wapiti, and beneath this is a sparse covering of white wool. In summer, this is grayish-brown in color, often with a reddish tinge; in winter, it changes to bluish-gray in the upper parts; the under parts and portions of the legs are white; a dark stripe runs along the back to the tail, which is black and completely surrounded by a conspicuous creamy-white patch on the hind quarters.

The muscular development of the Rocky Mountain Bighorn is remarkable. As G. O. Shields says: "While possibly not as graceful and elastic in his movements as the Deer or the Antelope, yet he will leap from crag to crag, will bound up over ragged ledges, over ice-glazed slopes, or down perpendicular precipices, alighting on broken and disordered masses of rock with a courage and a sure-footedness that must challenge the admiration of everyone who has an opportunity to study him in his mountain home." At the same time many of the "hair-breadth stories and wonderful pictures of Sheep hunting, in which men climb and cling by their finger-tips to overhanging rock faces," must be considerably discounted.

The fact that the Sheep often plunge head first has given rise to the fable that they land on their curved horns. This is absolutely untrue; they always strike ledges with their feet held close together. As Mr. Shields very pertinently remarks: "A full-grown ram weighs three hundred pounds or more; and while his horns would probably stand the shock of such a fall, his bones would not. His neck, and probably every other bone in his body, would, if he jumped from a precipice and fell fifty or a hundred feet, be crushed to splinters. Besides, if the rams could stand it, and come out of it safely, what would become of the ewes and lambs, which have not the big horns, and which follow wherever the rams lead? A Sheep never jumps down a sheer precipice of more than ten or fifteen feet; and whenever or wherever he does jump, he always lands on his feet." There is no question, however, of the agility of the Bighorn in making its way over crags and rim-rocks; it is often found as high as 12,000 feet above sea-level; and it is equally true that it can dash down declivities whose steepness seems to threaten its certain destruction.

The lambs, one or two at a birth, are born in May or June, and early give evidence of their courage and agility, following the ewes wherever they lead. While the ewes and lambs are feeding, there is always one ewe that acts as sentinel to warn the flock of approaching danger. According to John Muir, "in spring and summer the full-grown rams form separate bands of from three to twenty, and are usually found feeding along the edges of glacier meadows, or resting among castle-like crags of the high summits." In July and August all the Sheep may be

looked for on the open tops. In September they feed a trifle lower down. In October they are to be seen most of the time at the tops again. In winter on the Fraser river they may be found on the flatbenches that rise from the river bed; and they have been known to come down even to the level of the ranches.

At the town of Ouray, in Colorado, the citizens put out alfalfa for the Rocky Mountain Sheep in the winter, and have done so for several years. When it is first put out, the Sheep "race down hill" for it. The Sheep "make their appearance after the first heavy snows in December, and stay around until spring, some of them lingering along into April." Although so wild in summer, they will, in winter, come right into the town for their forage.

The wild enemies of the Bighorn are the Puma and the Lynx, and not a few lambs are annually carried off by golden eagles. The flesh of the Bighorn is considered by many hunters to be the most delicious of the mountains.

DALL MOUNTAIN SHEEP

Ovis dalli (*Nelson*)

Other Name.— White Mountain Sheep.

General Description.— See also general description of Rocky Mountain Bighorn. Size and form as in the Rocky Mountain Bighorn, but color entirely different. Color, white, or yellowish-white at all seasons.

Dental Formula.— See the formula given for Rocky Mountain Bighorn.

Pelage.—No noticeable variation, except a clearer tone of white in winter than in summer. Color entirely whitish, hairs usually tipped with rusty. Sometimes individuals have brownish areas, but these do not seem to be confined to any particular spot. Pelage very dense in winter.

Measurements.— Length, male, 5 feet; height at shoulder, 39 inches; tail, 4 inches. Horns along curve, 39 inches; circumference at base, 14 inches.

Range.— Mountains of Alaska and Kenai Peninsula. Rocky Mountains north of latitude 60° nearly to Arctic coast west of the Mackenzie, thence west to headwaters of the Noatak and Kowak Rivers that flow into Kotzebue Sound.

Food.—Grasses and "browse," leaves and twigs of shrubs.

Remarks.— This form is preeminently suited for a life in the snows of the northern regions, and its white coat is doubtless a response to this factor of its environment. There are three varieties.

Related Forms

Dall Mountain Sheep.—*Ovis dalli dalli* (Nelson). The typical white Bighorn of the above description. Sub-arctic America in Alaska Peninsula region.

Kenai White Mountain Sheep.—*Ovis dalli kenaiensis* Allen. Grayish-white instead of yellowish-white, tipping of hairs grayish instead of cinnamon. Kenai Peninsula, Alaska.

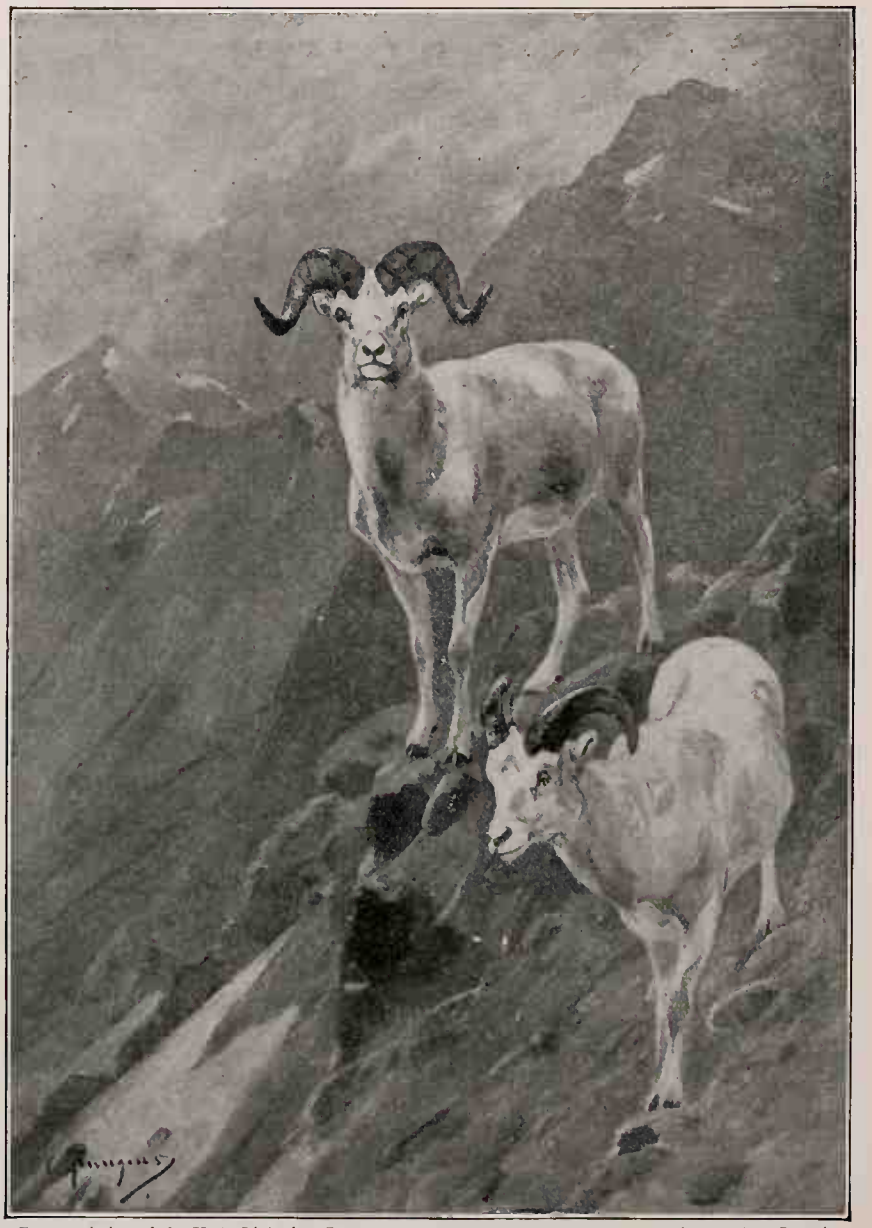
Fannin Mountain Sheep.—*Ovis dalli fannini* Hornaday. Practically identical with Dall's Sheep. British Columbia and Yukon.

The White Mountain Sheep, as Dall's Sheep is often called, is a very striking species, discovered in Alaska in 1884 by E. W. Nelson, and named by him *Ovis dalli* in honor of Prof. W. H. Dall. From October to the beginning of March its coat is pure white, long and thick; but its texture and color are so delicate that the pelage stains very easily. During the summer months it is of a dirty white hue and very short. Mr. A. S. Reed, who has been a successful hunter of the animal, says: "I killed my first *Ovis dalli* about the first week in September, and was very much disappointed in finding it to be quite short in the coat, and of a dirty rusty color, instead of the pure white that I had expected it to be." He adds: "There is one other peculiarity with regard to the coat of this Sheep — they all have a few black hairs in the end of the tail."

This species is smaller than the ordinary Bighorn, rams being about five feet in length, with a height at the shoulders of three and one-quarter feet. The ewes are somewhat smaller. The horns of a fairly large male measure nearly thirty-nine inches along the curve, and have a circumference at base of fourteen and one-half inches. They are, in the young rams, of an almost transparent amber color, but "the older ones are generally darker, and all of them, after being kept for some time, become just like those of the other varieties." Mr. Reed says that all of his have turned quite black. He has

noticed also one marked difference between the horns of Dall's Sheep and those of any other: "The crown or upper surface of the horn projects or overlaps the lower portion, as it were, in such a manner as to form a ridge running for some distance from the base, gradually tapering off until at the distance of from six to eight inches from the skull it ceases to be apparent."

Mr. Belmore Browne has recently contributed to *Outing* some interesting reminiscences of hunting this Sheep. He writes: "No animal lives a happier, lazier life than the mountain ram, in the summer time. The ewes are busy bringing up the lambs; and the young rams, not knowing where they belong, wear the fat from their ribs in futile visits between the staid old



By permission of the U. S. Biological Survey — Drawing by Carl Rungius

DALL MOUNTAIN SHEEP

The Dall, or White Mountain Sheep is a northern relative of the Bighorn. It is entirely white in color, to blend with the snow of its home, and there is little variation in its coat for summer and winter

rams on the high crags and the mixed bands on the lower slopes. Not so the old patriarchs. Away up on the shoulder of some great wilderness peak they loaf through the summer days. For hours at a time they lie in the soft mountain grass, looking out over the blue sea of the foothills. If they want water, a thousand rivulets fall from the everlasting snowfields; if they are hungry, they feed among the clean wind-swept pastures that lie at dizzy angles above the towering cliffs, and when their hunger is appeased they hunt a soft bed in the sunshine and doze away the happy hours. . . . The lambs are born in the early spring, and it is one of the marvels of nature how the tiny, defenseless things can live through the cold sleet storms common at that time of the year. Luckily their enemies are comparatively few. The Cougar's range ends at about the same northern limit as the range of the Rocky Mountain Bighorn, which is south of the Black Sheep ranges of northern British Columbia. Eagles are responsible for the death of many lambs, and undoubtedly that arch fiend the Wolverene, takes toll from the white bands. I have seen a white ewe spring up in alarm at the approach of an eagle, and stand on the alert by her lamb until the broad-winged marauder had passed."

Fannin's Sheep is a species of Mountain Sheep discovered in 1900 on the Klondike river, Yukon Territory, the specimen being named in honor of Mr. J. Fannin, Curator of the Provincial Museum at Victoria, British Columbia, to which institution it had been presented. It resembles Dall's Sheep to some extent, the general hue being white, with the shoulders, back, fore legs to knee, and hind legs to hock, outside, gray. The rump patch is white, and tail similar to back, but darker. On the front of the fore leg and on front of the thigh, in both cases extending to the hoof, is a brown stripe. It measures about five feet from nose to tail, and has a shoulder height of nearly three feet. Its horns are similar to those of Dall's Sheep, and have a basal circumference of thirteen and one-half inches, and a spread of twenty-one and one-half inches. It is a handsome and striking Sheep.

NELSON MOUNTAIN SHEEP

Ovis nelsoni *Merriam*

General Description.— See also general description of Rocky Mountain Bighorn. Much paler in color, smaller in size, and with smaller teeth than the Rocky Mountain Bighorn.

Dental Formula.— See formula for Rocky Mountain Bighorn.

Pelage.—Upper parts, pale dingy-brown. Underparts and legs, much darker, contrasting sharply with the white areas. Groin, hinder part of belly, inner aspect of thighs and posterior aspect of fore and hind limbs, white. Rump patch white, small, and completely divided by medium line of drab-gray.

Measurements.— Length, male, 50 inches; tail, 4 inches; hind foot, 12 inches; height at shoulder, 33 inches.

Range.— Desert mountain ranges of southern California and northern Lower California.

Food.— Leaves and twigs of shrubs.

This Sheep is a desert-loving variety, living in regions where water is scarce and found only in occasional springs. The pale color and small size are a response to an environment where colors are of a weak tone, and the scanty food supply militates against the size of the animal.

It is one of the smallest of the Mountain Sheep, averaging a little over four feet in length, with a height at the shoulders of less than three feet. It occurs in the mountains of southeastern California and in the peninsula of Lower California. In general characters it bears a resemblance to Stone's Mountain Sheep, but is somewhat paler.

STONE MOUNTAIN SHEEP

Ovis stonei *Allen*

Other Name.— Black Mountain Sheep.

General Description.— See also general description of Rocky Mountain Bighorn. Color darker than the Rocky Mountain Bighorn; horns more slender.

Dental Formula.— See formula given for Rocky Mountain Bighorn.

Pelage.—Above, blackish-brown and whitish mixed. A broad blackish stripe from occiput to base of tail. Face and sides of neck paler. Front of neck, chest and sides almost black. Rump patch, back of thighs, underparts to center of chest, where it ends in a point, and back of legs, white. Outside of legs blackish-brown. Tail black with some white hairs on lower surface. Hoofs black, horns pale brown.

Measurements.— Length, male, 5 feet, 6 inches. Horns over curve, 30 inches; circumference at base, 13 inches.

Range.— From Cassiar Mountains 61° north, south to headwaters of Nelson and Peace Rivers, Rocky Mountains; west to longitude 134°. Found in Stickeen, Cheonnees and Etsezas Mountains, Alaska.

Food.— Grasses and herbaceous plants.

Stone's is a dark form of Mountain Sheep living in the northern Rockies, in regions of bountiful rainfall, which fact has a tendency to produce dark color patterns in all animals. It is often called the Black Mountain Sheep, from its general dark appearance. Its size is about that of Dall's Sheep, but its horns have a much wider spread. A head, at one time in the possession of Mr. Robson of the Hudson's Bay Company, measured fourteen and one-quarter inches in circumference at the base, and had a spread of twenty-eight and three-quarter inches, the horns curving outward at the tips.

This Sheep presents a striking contrast to the White Mountain Sheep. It is blackish-brown and whitish mixed on the upper parts, a broad blackish stripe running to the base of the tail. The horns are pale brown.

ROCKY MOUNTAIN GOAT

Oreamnos montanus (*Ord*)

General Description.— Color, white with black horns and hoofs. Height about three feet at withers. Weight 180-300 pounds. Both sexes have horns which are never shed. Horns ridged and roughened at base and curving gently backward and somewhat outward, those of male being the larger. Horns of young animals short and straighter. Tail short and almost hidden in long hair of rump. Muzzle is haired, there are no facial glands, and in both sexes a beard grows from sides of lower jaw. Ears moderate sized, clothed with short hairs. Shoulders are higher than rump giving animal a humped appearance somewhat similar to that of the bison. A very shaggy animal.

Dental Formula.—Incisors, $\frac{0-0}{4-4}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3} = 32$.

Pelage.—Adults, both sexes: The hair is everywhere whitish from tips to roots. In winter the visible hairs are long and straight, being longest on neck, chest and midline of back from shoulders to rump. Underneath is a coat of short woolly fur more or less exposed in summer when outer coat is shed. A very distinct beard is found on both sexes growing from sides of lower jaw. Owing probably to stain, the tone of the white is seldom pure, but with a yellowish tinge more pronounced in summer. Young: Pelage same as adults, but during the first summer lacking the long hair of the outer coat.

Measurements.— Length, male, 5 feet; tail, 5½ inches; hind foot, 1 foot, 1 inch. Height at shoulder, 3 feet, 3 inches. Horn, along front curve, 10¼ inches; circumference at base, 5¼ inches; from tip across to tip, 5¾ inches. Female, somewhat smaller. Weight of female about one-fifth less than male.

Range.— The higher mountains from Alaska south to California, in former times, now probably only to Idaho. Never found far from regions of heavy annual snowfall. Today found in greatest abundance in British Columbia. By nature, denizen of the Alpine life zone, special preference being shown for localities where crags and cliffs are the features of the landscape.

Food.—Strictly herbivorous. Feeds upon scattered grasses among the rocks, pine needles and, in winter, upon any exposed vegetation it may find.

Remarks.— Erroneously called "goat," this animal is in reality an Antelope closely related to the Himalayan Serow, and is classified in a different section from that containing the domestic goat.

Related Species

Rocky Mountain Goat.— *Oreamnos montanus montanus* (Ord). The animal described above. Ranges in the Cascade Mountains north to British Columbia.

Columbia Rocky Mountain Goat.—*Oreamnos montanus columbianus* Allen. Much larger than typical *montanus*, with longer and narrower skull. Found in British Columbia.

Allen Rocky Mountain Goat.—*Oreamnos montanus missoulae* Allen. Smaller than either of the above, with narrow skull. Found in Montana.

Kennedy Rocky Mountain Goat.— *Oreamnos kennedyi* Elliot. Differs from *montanus* in skull characters, and has larger, more widely flaring horns. Found in southern Alaska.

ROCKY MOUNTAIN SHEEP

An unusually large group for one picture, which a patient hunter with his camera was lucky enough to obtain in Colorado

Here we have another case in which an animal has been popularly misnamed. Just as the Pronghorn has been miscalled the American Antelope, it not being a true Antelope, so our friend *Oreamnos montanus* is popularly known as the Rocky Mountain Goat, although it is not a Goat, but rather a goatlike Antelope. It is, in fact, most nearly related to the Alpine Chamois and the Himalayan Serow.

The so-called Goat of the Rocky Mountains is a sturdy animal set on short, stout legs, and

ROCKY MOUNTAIN GOAT

This is one of the few animals which are white at all seasons of the year. The horns and hoofs are jet-black, forming a striking contrast to the beautiful coat

weighing somewhat over 250 pounds. Its hoofs, upon which the bold climber has to depend so largely for its safety, are aptly described as consisting "of an ingenious combination of rubber-pad inside and knife-edge outside, to hold the owner equally well on snow, ice, or bare rock." Its horns, present in both sexes, are about ten inches long, rough for about half their length, the remaining portion being smooth, and jet black; they curve backward. The animal stands about three feet high at the shoulders.

The fleece of the Rocky Mountain Goat is entirely yellowish white, and, like the pelage of the Musk-Ox, consists of a fine wool next the skin, through which grows an outer covering of long, straight hair. This hair being erect along the line of the back, and longer over the shoulders and hind quarters, gives a double-humped appearance to the animal. From the color of its fleece, it is sometimes called the White Goat.

In spite of the comparative inaccessibility of its haunts, the range of the Mountain Goat is apparently lessening. At any rate, sportsmen and hunters find that it occurs in much smaller numbers than formerly, mainly in the States of Idaho, Montana and Washington, and northward throughout British Columbia. Amidst the grandest, wildest scenery, above the timberline, crossing the faces of precipices that seem almost perpendicular, dwells *Oreamnos* in serene and contented isolation.

The well-known writer Stewart Edward White, who hunted the animal in the Cascade Mountains, a few years ago, gives in *Outing* an admirable description of typical Goat country. Mr. White had been hunting Elk in the dense forests at the foot of a mountain, when one of his companions suggested that they should go to the top and look for Goats, adding "It isn't very far." Says Mr. White: "It was not very far, as measured by the main ranges, but it was a two hours' steady climb, nearly straight up. . . . Three times we made what we thought was a last spurt, only to find ourselves on a false summit. After a while we grew resigned; we realized that we were never going to get anywhere, but were to go on forever . . . and then at last the sudden, unexpected culmination. We topped a gently rounded summit; took several deep breaths into the uttermost cells of our distressed lungs; walked forward a dozen steps — and found ourselves looking over the sheer brink of a precipice. Across the face of the cliff below us ran irregular tiny ledges; buttresses ended in narrow peaks; chimneys ran down irregularly to the talus. Here were supposed to dwell the Goats. We proceeded along the crest spying eagerly. We saw tracks, but no animals. At last we found ourselves cut off from farther progress. To our right rose tier after tier of great cliffs, serenely and loftily unconscious of any little insects like ourselves that might be puttering around their feet. Straight ahead the ledge ceased to exist. To our left was a hundred-foot drop."

Owen Wister says: "It has been stated that in the winter season, like Mountain Sheep, the

Goat descends and comes into the valleys. This does not seem to be the case. He does not depend upon the grass, if indeed he eats grass at all. His food seems to be chiefly the short, almost lichen-like moss that grows on the faces and at the base of the rocks and between them in the crevices. None of the people in the Methon country spoke of seeing Goats come out of the mountains during the winter. I have not sufficient data to make the assertion, but I am inclined to believe that the Goat keeps consistently to the hills, whatever the season may be, and in this differs from the Mountain Sheep as he differs in appearance, temperament, and in all characteristics, excepting the predilection for the inclined plane; and in this habit he is more vertical than the Sheep."

Of hunting them he adds: "There is no use in attempting to hunt them from below. Their eyes are watchful and keen, and the chances are that if you are working up from below and see a Goat on the hill, he will have been looking at you for some time. Once he is alarmed, ten minutes will be enough for him to put a good many hours of climbing between himself and you. His favorite trick is to remain stock-still, watching you till you pass out of sight behind something, and then, he makes off so energetically that when you see him next he will be on some totally new mountain. But his intelligence does not seem to grasp more than the danger from below. While he is steadfastly on the alert against this, it apparently does not occur to him that anything can come down upon him. Consequently, from above you may get very near before you are noticed."

Of all big game animals the Mountain Goat is by common consent considered the most stupid. Mr. White's opinion is that "Goats are either fools or great poets;" and Colonel Roosevelt's pronouncement concerning the animal is: "Verily the White Goat is the fool-hen among beasts of the chase." This was uttered after he had shot a buck, and one of its accompanying does had run off for about a hundred yards and then stopped to look at the Colonel!

Although the White Goat is essentially a mountain animal, Mr. John Fannin has "known Goats to be shot within a few hundred yards of the sea-level, and to be captured while in the act of swimming rivers or wide stretches of salt water."

Except during the pairing season, November, and in the middle of winter, they are not gregarious. The young are born in the spring, and remain with their parents till the following spring, but no large flocks are seen.

Up to 1903, only four Mountain Goats had been seen in captivity east of the Rocky Mountains. In 1905, Dr. Hornaday personally convoyed a herd of five goats from Fort Steele, British Columbia, to New York, and in May, 1908, the first Mountain Goat ever bred in captivity was born in the Zoological Park in that city. On June 8, 1910, a second kid was born.

ROCKY MOUNTAIN GOAT

Although sure-footed and fearless mountain climbers, the Goats lack the grace and recklessness of the sheep

It was amusing to see these denizens of the mountains clambering over the roof of their house in the Park. The food supplied to them consisted of "best clover hay, crushed oats, sliced carrots, and chopped apples." The legislature of British Columbia a few years ago set apart for the preservation of the Mountain Goat about 450 miles of territory, between the Elk and Bull rivers and around Monroe Lake, since known as Goat Mountain Park, and here a thousand of them found a safe retreat from the insatiable hunter.

The skin of the White Mountain Goat was formerly in demand by the Indians, who made the fleece into blankets, but of late years the demand for these has ceased. Otherwise the skin has no commercial value, and the flesh is not very palatable.

By permission of the New York Zoological Society

ROCKY MOUNTAIN GOATS

Part of a thriving colony now living in the New York Zoological Park

THE PECCARY FAMILY

(*Tayassuidæ*)

PECCARIES clearly belong in a family by themselves. Their nearest relatives are the wild boars of the Old World, and the domesticated swine, but there are well-marked points of difference from these also. The American family contains several species in Central and South America, but only one north of the Rio Grande.

Distinguishing marks are: upper tusks directed downward instead of upward; three toes instead of four on hind feet; a complex stomach somewhat like that of the ruminants; twelve premolars, twelve molars, and a total of 38 teeth; whitish collar, and black dorsal stripe; and a large musk gland in which is secreted a quantity of evil-smelling oily substance.

Fossil remains of Peccaries, some belonging to living and others to extinct species, occur in Pleistocene deposits of both North and South America. In addition to these, certain extinct Pliocene and Miocene hog-like animals seem to indicate the parent-stock from which both the Peccaries and the true pigs have been derived.

COLLARED PECCARY

Pecari angulatus (*Cope*)

Other Name.— Texas Peccary, Musk Hog.

General Description.— A small pig-like animal of about 40 pounds weight. Sexes similar. Tail rudimentary. General appearance black, grizzled with grayish, white. A large scent or musk gland just under skin of rump. A broken whitish collar just in front of the shoulders, and a mane of long erectile hairs from occiput to rump. Strong straight tusks just visible beyond lips. Toes, four in front, three behind. Hair coarse and bristle-like.

Dental Formula.— Incisors, $\frac{2-2}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3} = 38$.

Pelage.— ADULTS: Above, the hairs are black with grayish white annulations giving a somewhat grizzled appearance most noticeable on muzzle, cheeks and under side of head. A mane of black hairs, conspicuously longer than the other hairs, runs from back of the ears to the scent gland on the rump. An incomplete "collar" of soiled whitish runs from just before the shoulder obliquely upward and backward to the mane which breaks the continuity of the collar. Ears with five stripes of white hair internally, blackish externally. Below, the hairs vary from reddish-black along the ventral line to brownish-gray along groin and pit. Hairs everywhere long, hard and glossy. YOUNG: At first brownish-yellow touched with black above, plain yellowish-gray below. A black stripe in the position of mane of adult, whitish collar and annuli of adult reddish in young.

Measurements.— Total length (sexes same size) 3 feet, 2 inches. Height at shoulders, 32 inches.

Range.— Plains and desert areas up into lower mountains from Northern Mexico into Texas.

Food.— Roots, acorns, pecans and miscellaneous vegetation.

Remarks.— This animal is the only native "pig" found in the United States. However, while superficially bearing a close resemblance to the Old World pigs, the common domestic swine, it is a member of a distinct family based upon important internal structures.

RELATED SPECIES

The Peccaries are a compact group containing several quite distinct varieties in Central and South America, but only one well-established species with its subspecies north of the Rio Grande. These subspecies are all very much alike.

Collared Peccary, or Texas Peccary.— *Pecari angulatus angulatus* (Cope). The animal above described.

Sonora Peccary, or Yaqui Peccary.— *Pecari angulatus sonoriensis* (Mearns). Larger and paler than the Texas Peccary. Sonora, Mexico, and region between Texas and Gulf of California.

The Peccaries are the American relatives of the wild boars of the Old World, but there are certain well-marked differences between the two groups. The points of the upper tusks of the Peccary are directed downward instead of upward as with the swine; the Peccary has no external toe on its hind feet; it has a rudimentary tail, and a complex instead of a simple stomach. In the middle of the back the Peccary has a large gland containing an oily substance smelling somewhat like musk; hence the animal is sometimes called the Musk Hog. When in anger the Peccary ejects this substance, the odor emitted is very rank.

COLLARED PECCARY

The wild relative of the pig tribe, sometime called the Musk Hog, is fond of the jungles of tropical America, but is also at home among the cactus and sage of our southwestern states

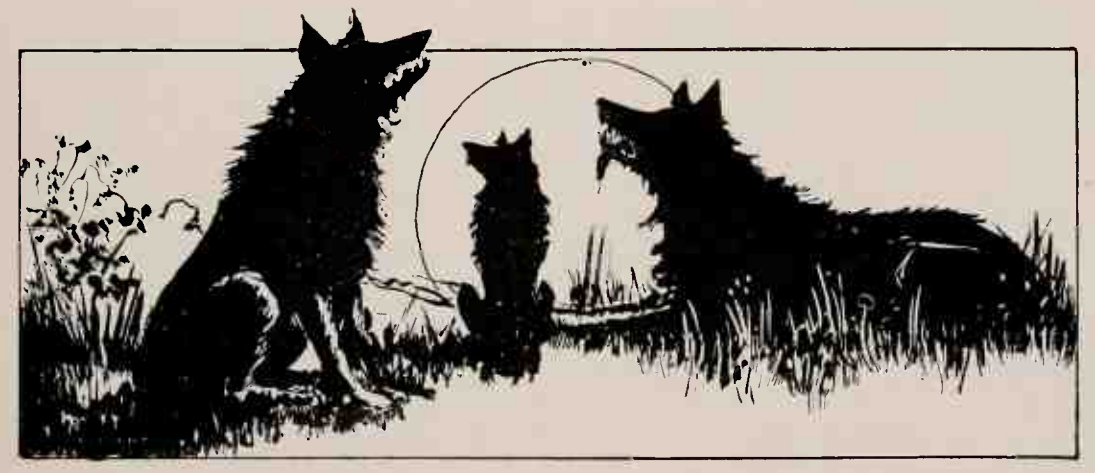
In appearance the Collared Peccary resembles a small common hog. The range of the American species extends from the Red River of Arkansas, latitude 34° south through Mexico, Central and South America to the Rio Negro of Patagonia. Elliot says of the Peccaries: "These animals are fearless and pugnacious, associate in droves, sometimes of considerable numbers, and, when attacked, all assume the offensive, and are capable of doing much damage with their sharp tushes; and a man in the midst of a number of enraged Peccaries is fortunate if he is able to find a tree to climb, that being about the only method of saving his life." Mr. A. G. Requa, relates an experience of his when treed by Peccaries in Mexico. He had just shot a wild turkey, and, being warm, had sat down on a rock to rest, taking off his coat. "I had not sat there," he writes, "more than five minutes before I heard the sharp noise of the Peccaries. They came in sight not more than twenty yards below me. I fired at one, and, just as I intended, only crippled him. He set up a great squealing, and sure enough, here they came! I was just a little excited, and started for a tree, forgetting my coat and turkey. I had scarcely time to get up when they were around the tree, and, instead of twelve, they kept coming until there were at least

two hundred. I commenced shooting, and killed five with my rifle. . . Fortunately, I had both revolvers, and a belt full of cartridges for them; so I went at them. They were chewing the tree, and climbing over each other trying to get at me. I tried to count them, and found that there were over two hundred left, and I had killed twenty-three. The Peccaries showed no signs of leaving. It was now noon, and very warm. They would root around, then come back to the tree, and grunt, and paw, and bite the tree; then they would cool down a little, would go a short distance away, root around awhile, then come back again. I was getting tired of being treed. If only the boys could hear my firing and come over.

"One o'clock came, then two. Three o'clock came, then four, and no signs of the boys. Some of the pigs would feed while others stood guard; then they would change off. I was so tired. I took my belt off and buckled myself to the tree, so that I would not fall out. Seven o'clock! they still camped near me. Then the sun went behind the mountain; darkness came on, and I was thirsty, hungry, and tired; but, worse than all, I was a prisoner. Twelve o'clock! The moon shone brightly, and I could see my sentinels scattered around. Two o'clock! Then came a signal from some of the outside ones; the rest snuffed the air, then away they all went. I unloosed the belt and got down, more dead than alive — so stiff I could scarcely walk. I went first to where I left my turkey and coat. The turkey had been eaten, and my coat had been thoroughly chewed. I started for camp, where I arrived just at daybreak. Two of the boys were out on horseback, hunting for me."

The chief food of Peccaries consists of nuts and roots, in addition to worms, insects, and carrion. The female produces one or two young once a year. The flesh is somewhat inferior to pork, and the musk gland must be removed immediately after the killing; otherwise the meat will be tainted.

There are several forms of the Peccary in Mexico; and in South America occurs the White-lipped Peccary, a larger species than the Collared variety; it congregates in very large herds, and does much damage to growing crops. Its lips and breast are white.



ORDER OF FLESH-EATING ANIMALS

(Carnivora)

FLESH-EATING mammals are known by the Latin name *Carnivora*, which means "Flesh-eaters." The order is also known as *Feræ*, and comprises a wide circle of beasts of prey which live on flesh usually killed by themselves. Most of the members are fierce and active, the larger ones being dangerous to man.

Because of their flesh-eating habits, we find this order distinguished by having certain teeth especially sharp and powerful. The teeth are of three sorts, incisors, canines and molars. The canines are prominent and dagger-like as a general rule, while one or more of the molar teeth have prominent shearing edges forming the so-called "carnassial" or flesh tooth. The lower jaw is articulated in a manner to secure strength and freedom in an up-and-down plane. The clavicle is absent, or at best incomplete. The radius and ulna are distinct bones. The feet of the flesh-eating animals are not so long as in the hoofed animals. The *Carnivora* as a rule walk solidly on the whole foot, instead of daintily on the tip of the toe, and are therefore called plantigrade. They are further provided with sharp claws which can be pulled in, or retracted, by many animals.

The *Carnivora* have two suborders, the *Pinnipedia*, an aquatic group whose feet have been modified into flippers — such as the Seals and Walruses; and the *Fissipedia*, which have several toes on each foot. There are never less than four digits, more often five, and each bears a claw. The first and second digits are never opposable as thumb and finger. The Cats, Dogs, Bears, Raccoons and the Weasel tribe are all members of this suborder. Some of these, the Kodiak Bear for example, may be reckoned as the mammals most to be feared on the North American continent, while at the other end of the series is found a bloodthirsty carnivore, the Pygmy Weasel, small enough to prey on the smallest. Characters common to all these mammals are mobile limbs, adapted for walking, toes free with long sharp claws, external ears well developed, incisors three on each side above and below, stomach simple, caecum present, mammae abdominal. Some of the members of this suborder walk full foot or are plantigrade, others are digitigrade, while still others are midway between the two.

The following diagram illustrates typical members of the *Fissipedia* in North America.

ORDER OF FLESH-EATING ANIMALS (CARNIVORA)

Sub-Order Fissipedia

Families

(In North America)

Dogs (*Canidæ*)	**Cats** (*Felidæ*)	**Bears** (*Ursidæ*)	**Raccoons** (*Procyonidæ*)	**Weasels** (*Mustelidæ*)
(Typical species)	(Typical species)	(Typical species)	(Typical species)	(Typical species)
Coyote	Cougar	Polar Bear	Raccoon	Weasel
Wolf	Jaguar	Grizzly Bear	Ring-tailed Cat	Marten
Red Fox	Ocelot	Big Brown Bear		Mink
Kit Fox	Jaguarondi	Black Bear		Wolverene
Arctic Fox	Canadian Lynx			Ferret
Gray Fox	Wild Cat			Skunk
				Badger
				Otter

THE DOG FAMILY

(*Canidæ*)

THIS family includes the Dogs, Wolves and Foxes. Their claws are non-retractile, that is, they are fixed, and are not adapted for use as weapons. All members of the Dog family walk upon the front portion of their feet, or are digitigrade. They have five toes on the front feet, and four toes with a rudimentary or imperfect toe above the others on the hind feet.

The Dog Family is not characterized by many admirable traits in its wild state. It is usually cunning, vicious and treacherous, and exhibits no bravery except where there are numbers of its own kind. It is furtive and sneaking, looking for every unfair advantage, and, once in danger, is an arrant coward.

From the commercial side, however, the family is entitled to respect. The pelts of both Wolves and Foxes are of value, those of certain varieties of Foxes bringing high prices.

Photograph by W. L. Finley

THE LONE SCOUT OF THE PLAINS

There is no more typical animal of the western plains than the Coyote

COYOTE

Canis latrans *Say*

Other Name.— Prairie Wolf.

General Description.— Like a shepherd dog in size and appearance. Nose sharp and slender; ears fully haired, erect, pointed. Pupil of eye circular. Tail of moderate length, bushy. Hair long and thick, color buffy gray and black above, below whitish. Carnassial tooth (4th premolar) very large with extensive cutting edge.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{2-2}{3-3}$ = 42.

Pelage.— Sexes identical. ADULTS: Muzzle pale fulvous grizzled with gray and black; top of head grizzled gray; ears deep fulvous sprinkled with black; upper parts buffy gray and black; under parts and upper lip whitish; throat hairs tipped with blackish;

fore legs and feet dirty white, clay color on outer side; hind legs and feet fulvous on outer side, white on inner side and top of feet; tail tipped with black, underneath white basally. YOUNG: Not so contrastingly marked, the pelage more of a gray monotone.

Measurements.— Sexes practically equal. Total length, 4 feet; length of tail, 16 inches; hind foot, 7 inches; ear, 4¼ inches. Weight, 30 to 40 pounds.

Range.— Northern valley of the Mississippi westward on northern edge of the plains to the Rockies in Alberta.

Food.— Almost entirely carnivorous. Small mammals and birds, mice, hares and cotton-tails, occasional deer or antelope, ground squirrels, prairie-dogs, frogs, snakes and sometimes sheep.

Remarks.— Coyotes of different species are found throughout almost the entire western half of North America from Mexico to Alaska. Accordingly as the influences of environment vary, the species of this genus become differentiated, and authorities recognize today no fewer than 12 to 14 species and subspecies exclusive of the large wolves. The principal variations in characters are to be found in size and coloration, the general appearance of all these forms being sufficient to show clearly their relationships. The most important forms only are mentioned below.

RELATED SPECIES

Coyote, or Prairie Wolf.— *Canis latrans* Say. This form is typical of most of the genus and it is one of the largest. It ranges the farthest north of the group.

Nebraska, or Plains Coyote.— *Canis nebracensis nebracensis* Merriam. Smaller, paler, skull smaller. Arid plains from eastern Colorado and Montana to Assiniboia.

Texas Coyote.— *Canis nebracensis texensis* Bailey. Smaller, brighter and more fulvous than *latrans*. Gulf region of Texas northward as far as Oklahoma.

Mountain Coyote.— *Canis lestes* Merriam. Similar in size and color to *latrans* but skull and teeth smaller. High plains of interior of British Columbia, Washington and Oregon southward over the higher lands of the Great Basin, the Sierra Nevada and the Rocky Mountains to the plateau of Northern Arizona and thence along the continental divide as far south as Mexico.

Oklahoma Coyote.—*Canis frustror* Woodhouse. Smaller than *latrans*, color pale, ears short. Oklahoma.

Mearns Coyote.— *Canis mearnsi* Merriam. Size small, color bright, skull and teeth small. Southern Arizona.

Desert Coyote.—*Canis estor* Merriam. Size small, color pale, teeth small. Deserts of eastern California, Nevada and Utah.

California Coyote.— *Canis ochropus* Eschscholtz. Smaller and darker than *latrans*, more highly colored, ears larger, skull and teeth smaller. San Joaquin Valley, California.

From southern Mexico to northern Alberta in Canada, and from Michigan to the Pacific coast, the Coyote, or Prairie Wolf, may be found pursuing its devious ways. It is much smaller than the Gray Wolf and far less savage; and its foxlike muzzle and ears seem to be an index to its craftiness and cunning. The typical Coyote gained its specific name *latrans* ("barking") from the fact that it habitually barks. Mr. Seton considers "the voice of the Coyote is one of its most remarkable gifts." He thinks that some of the animal's calls are "the outcome of the pleasure it finds in making a noise." Soon after the sun goes down the Coyote begins its "evening song." This is "a series of short barks, increasing in power and pitch till it changes into a long squall. One Coyote begins and immediately two or more join in, making so much noise that newcomers think there must be a hundred wolves out there."

An average male Coyote is about four feet in length, stands a little under two feet at the shoulders, and weighs a little over thirty pounds. The females are less.

Coyotes mate in February, and the cubs, usually five to seven, but occasionally as many as ten, are born in April. The den is either a hole excavated by the old Coyotes or, it may be, the abandoned hole of some other animal. The eyes of the "little strangers" open on the eighth or ninth day from birth. When they are about six weeks old solid food is brought home to them by the parents. The young leave the home nest in the fall.

The dietary of the Coyote has been described as "every kind of fish, flesh, and fowl that it can master, dead or alive." Turkeys and even sheep it will attack when pressed by hunger, and in some of the Southern States it is said to have developed a liking for watermelon. It will often slink after a hunter and pick up any offal it can. The Coyote shows great cunning in hunting its prey. When after jack-rabbits, a pair of Coyotes will work together; antelope and deer they often hunt in packs, spreading themselves into a wide circle and endeavoring to exhaust the quarry.

The Coyote does not attack man, but shows considerable ferocity with animals of its own size. Mr. G. O. Shields thus describes a fight that he saw between a Coyote and a Wildcat over the shoulderblade of a mountain sheep that he had killed: "The Cat, of course, depended mainly on its claws as weapons, while the Coyote's best hold was with its teeth. The Cat was quicker and more elastic in his movements,

while the little Wolf was the more deliberate, and the better stayer. . . . When I first sighted the contestants, they were in the midst of a sanguinary round, but finished it in a few seconds, and, separating, as if by mutual consent, both backed off a few paces and sat down. The Wolf growled and snarled, showed his ivories, and licked his wounds in turn, while the Cat hissed, spat, and caterwauled, much as a domestic cat does when engaged in a family row. Finally the Coyote started for the Cat, and no sooner had he taken a step than the Cat shot into the air, clearing at least ten feet in a single leap, and lit on top of the Coyote. Then there was snapping, clawing, snarling, yawling, howling, and shrieking. Teeth and toenails contended valorously for the victory; the air was filled with hair, and rent with cries of rage and shrieks of pain. . . . When both seemed exhausted, they again drew off. Again they sat nursing their wrath. . . . After the fifth round the rest was much longer than at the end of either of the others. . . . I decided to assume the role of referee, and mentally declaring the fight a draw, took a shot at the Cat. This broke up the affair suddenly."

Though less cunning than the Gray Wolf, the Coyote, as has been stated above, is decidedly crafty. It is an adept in avoiding snares and traps, although hunger often induces it to partake of poisoned bait. It seems to know when a man is unarmed, and will sit undisturbed within gunshot; but when the hunter has his gun it is a different matter. Dr. Hornaday tried twice for two weeks, in Montana, to shoot a Coyote, and could not get within three hundred yards of one, and then only a running shot.

The Coyote has great speed. Mr. Seton places it at its best in the 2.30 class. It, however, when young, falls a prey to the gray wolf, eagle and horned owl.

Photograph by the U. S. Biological Survey

COYOTE AT BAY

The cowardly disposition of the Coyote is shown here, as the animal backs up against a rock, to pose for an unwelcome portrait

A small band of Coyotes hunting together has been known to kill Mountain Sheep which had been shut into a small pocket by an avalanche. Fawns are of course preyed upon in summer and early fall, but the adult Deer only in winter when the crust will sustain the Coyotes, but not the Deer. Forest rangers who have seen Coyotes pursuing Deer in this manner state that a band of five or six will overtake a Deer and hamstring it very quickly on a weak crust of snow. Many calves also are killed by Coyotes in the mountain parks, and in certain localities it is almost impossible to raise chickens and turkeys because of their depredations.

In some parts of the West, until recently, Coyotes were unusually abundant and destructive. Numbers were seen on the plains where they mixed freely with the cattle, and evinced little fear of man unless he carried a gun. Dur-

ing the day one was in almost every extensive weed patch or growth of rank marsh grass, ready to pick up the turkeys and chickens which strayed too far from the ranch buildings. Coyotes have been seen catching Meadow Mice and playing with them like a cat.

Mr. Ernest Ingersoll, in the *Popular Science Monthly,* gives this personal description of a Coyote attacking a mother Antelope and her fawn: "I remember at a place where I was encamped for two or three nights in southwestern Wyoming, the rough ledge of a butte-face just across the creek was the home of a family of these Wolves, and I often saw the mother lying at the mouth of their den, and the four whelps gleefully romping in the sunshine. The father of the family kept out of view at first; but later I caught sight of him in pursuit of a doe Antelope and her fawn. The doe was backing away over the plain, keeping the little one, which seemed to understand its part perfectly, close to her hind legs. Following her closely ran the Wolf, often making a dash to the right or left to get at the fawn; but each time the brave little mother, whisking alertly, would present to him her lowered head and make a dash at his skull with her sharp fore-hoofs. Thus she retired, but I fancy that the pursuer's longer breath and varied tactics won the day."

The nocturnal prowlings, secretive disposition, and remarkable craftiness of the Coyote, together with the annoyance it has the power to inflict, cause it to figure prominently in the myths and religious history of the Indians of the far West. The Indians give this animal a curious position in their legends, some paying him high honor for his cunning, while others give him a low place because of his cowardliness. In some of these folk-lore tales he is called "Old Man Coyote," and varied are his advantures.

"In parts of the West where fruit growing and farming are dominant industries," says Dr. A. K. Fisher, "it may be wise to encourage Coyotes and Bobcats within certain limits, provided poultry and sheep are properly protected at night. Numerous ranchmen and fruitgrowers have learned by experience that these animals, if unmolested, will free their premises from rabbits and other crop or tree destroyers. Where Coyotes have been allowed to do their work thoroughly, they are fully appreciated, and many ranchers would almost as soon shoot their own dogs and cats as their wild benefactors. The Coyote feeds on large insects, as May beetles, crickets and grasshoppers, and accomplishes much good."

The skin of the Coyote is not very valuable, being worth, in raw state, about seven dollars.

GRAY WOLF

Canis nubilis (*Say*)

Other Names.— Timber Wolf, Buffalo Wolf.

General Description.— A large dog-like animal, the male reaching a weight of 100 pounds. Nose rather elongate and pointed. Ears moderately high, erect, pointed. Tail of medium length, bushy. Legs powerful and feet large. Hair long and coat heavy. Predominating colors of pelage gray and black with whitish gray below. Claws horn color. Eyes straw-colored.

Dental Formula.— Same as given for Coyote.

Pelage.— Adults: Sexes similar; seasonal variation slight. Great range of individual variation in color. Gray or black, sometimes brownish gray or brownish white; many of the hairs black-tipped making irregular wavy black markings which are heaviest in the middle of the back; underfur dusky. Underparts and sides whitish gray, paler beneath; face gray; ears rather fulvous. Tail gray with black markings like back. Outside of legs somewhat fulvous, inside like under parts. Young: Grayer throughout than adults.

Measurements.— Length, male, 5 feet, 2 inches; tail, 16 inches; height at shoulder, 27 inches; weight 75 to 105 pounds. Female, length, 4 feet, 7½ inches; tail, 12 inches; height at shoulder, 25 inches; weight, 55 to 80 pounds.

Range.— In general the Great Plains region.

Food.—A meat-eater preying, at times, on almost all of the other animals of the region in which it lives. Principal diet mice, hares, squirrels, deer, the young of elk and moose, and in settled districts domestic cattle, horses and sheep.

Remarks.— The status of the wolf classification is shrouded with some uncertainty, and authorities are not agreed as to the exact number of species to make, or what their ranges should be. The following arrangement of related species is something of a compromise on the best sources.

Related Species

Gray Wolf, Timber Wolf, or Buffalo Wolf.—*Canis nubilis* (Say). The typical form, described above. First taken near Council Bluffs, Iowa. Definite range not determined.

Gray Wolf, or Timber Wolf.—*Canis occidentalis* (Richardson). Shares with the above species the common names of Gray Wolf and Timber Wolf. Size very large, color usually light, white to grizzled gray. Color variable sometimes through different degrees of gray to all black. Doubtfully distinct, according to some writers, from Old World Wolf, *lupus.* Canada from plains of the Saskatchewan to Arctic Coast.

By permission of the New York Zoological Society

YOUNG GRAY WOLF

In pioneer days Wolves were a menace to settlers, just as they are today on the plains of Siberia. They still make such serious inroads upon cattle and sheep in the West, that bounties are offered for their destruction

There has been much diversity of opinion among naturalists as to whether the Gray Wolf of North America is specifically identical with or distinct from the ordinary European Wolf. Dr. Merriam, who was supported in his view by the late St. George Mivart, holds that the two animals are one and the same species, but of recent years the opposite view has received an increasing number of adherents. As regards the American Gray Wolf, some naturalists consider it to be identical with the Timber Wolf, while others hold that the two represent different species.

Photograph by Mrs. E. T. Cameron

TIMBER WOLVES

An unusual picture, taken in the open, showing two full-grown specimens at ease

The fact is, that so many variations in respect of shape, size and color exist among the Wolves of America, that it is often difficult to assign a particular Wolf to a certain species.

The Gray Wolf formerly ranged over the greater part of the North American continent, but was most abundant in the great plains. When the Buffalo herds in countless thousands were seeking new pastures, it was the Gray Wolf from which the old bulls had time and again to defend the newly born calves; and many a feeble, wounded, or aged Buffalo also has fallen to the same beast of prey. Reindeer and Moose likewise are among its victims. In Alaska there is a large white variety, and C. J. Jones and a companion, in 1899, above the Arctic Circle, "were so beset by packs of huge and fierce White Wolves, seeking to devour their five living musk-ox calves, that for over forty-eight hours they fought them continuously at short range, killing a Wolf at every shot."

The Gray Wolf is abroad in the daytime as well as at night, and hunts both solitary and in pairs, and, especially in winter, in packs. The early American farmer often awoke in the morning to find that Gray Wolves had during the night killed "fifteen or sixteen sheep, simply tearing open their throats without otherwise damaging the carcasses." And even today in the western ranges Wolves still kill large numbers of sheep, horses, and cattle. The Gray Wolf has wonderful endurance, enabling it to run down and kill even Foxes, whose swiftness is proverbial. Deer and Antelope are favorite prey, although sometimes a large buck has been known to kill a Wolf with a blow of his sharp hoof.

A typical Gray Wolf is about five feet in length, has a height of twenty-seven inches at the shoulders, and is about twenty-nine inches in girth at the chest. Mr. Seton caught "a good-sized male" in Colfax County, New Mexico, in 1893, which measured sixty-two inches from nose-tip to tail-bone tip, its tail being six-

teen inches, its chest girth twenty-eight and one-half inches, and its weight 102 pounds. A female taken at the same place weighed only seventy-five pounds. As already stated, the color variation among Gray Wolves is very great. The skin of Mr. Seton's New Mexico specimen was generally a dull yellowish-white; cheeks, chest and inside of hind legs nearly pure white. The outer side of each limb, upper part of the muzzle, and the crown were tinged with a clear pale sienna. From between the eyes, over the head and back were black-tipped hairs ending on the tail in a black spot. The under fur on the under parts was brownish gray, becoming much darker and browner on the upper parts. Below the spot on the tail there was no under fur, but "evidently a skin odor gland." The claws were of dark horn color. Mr. Seton thinks this specimen represents the prevalent color.

Mr. F. R. Burnham gives the following observations on a Wolf hunt: "While following the tracks of two Grizzlies, we came upon a bunch of eleven Wolves; six were black and five were gray. A day or two before they had pulled down a young cow Moose and were making this particular spot their headquarters. Mac and I watched them for over an hour through the glasses. We were probably within 400 yards of them. Their actions were similar to a collie dog's. The youngsters would play, run and jump and roll each other as you have seen dogs do many a time. On the other hand, the older Wolves would snarl and snap at each other, and especially if one was disturbed during his slumbers. After watching them for over an hour we made our stalk and arrived within 100 yards without their having scented us. Upon doing that, they immediately scattered, and I managed to get five out of the bunch. Four were black and one was gray. Of the four black ones, two were in very good coat and two poor. The gray had the best pelt of all. The two poorer pelts of the blacks were a shade between a blue-black and a snuff color. The front paws were a deep tan; also, the throats had a tendency to that shade. The smallest of the five weighed ninety-two pounds; the largest, if I remember correctly, 118 pounds."

Gray Wolves mate any time between the last week of January and the first week of March; the colder the region, the later the pairing. The consensus of opinion among those who have had the most favorable opportunities of studying these animals seems to be that Gray Wolves pair and that the partnership is permanent. The den may be a hollow stump of a tree, a hole in the ground, dug by the parent Wolves, or some natural cave. Sometimes two or three she-wolves will use the same den together. Some observations of a professional wolfer, given below, are informing as to the interior of the den. The gestation period is sixty-three days, and the litters number from three to thirteen pups, six or seven being the usual number. The eyes of the little ones do not open till the ninth day. The she-wolf has the reputation of being an excellent mother, never killing or eating her young as the Prairie Wolf does. She may often be seen turning over rocks to obtain a supply of crickets of which the pups are fond.

The Bad Lands, alkali deserts, and the Hudson Bay Barren Grounds still harbor large numbers of Gray Wolves; but the Wolf of today is comparatively shy, doubtless due to its experience with modern firearms. Indeed, shooting can no longer be depended upon to restrict its numbers. Some observers consider the Gray Wolf a more cunning animal than the Fox. It certainly shows great ingenuity in evading traps; and, although bounties ranging from two dollars to fifteen dollars are offered for its destruction, cattlemen in some States offering as high as fifty dollars for a notorious freebooter, considerable skill and astuteness have to be used to secure one.

A professional wolfer says: "The time to catch the Wolves is when they are going back to their dens; if the dam sees you, she will try to lead you away. There's nothing to be afraid of about Wolves, when once you know their peculiar way of acting. Their jaws and teeth are as stout and strong as a pair of sheep shears, and they are powerful biters, but a Wolf won't fight as long as he can hide his head. Generally at the bottom of the den or hole there is a little space or boudoir where they raise the pups, and at one side of this room there is a little hole. When the hunter crawls into the den, the big Wolf will hide her head in this little hole and think she is safe."

The fur of the Gray Wolf makes a fine robe, and a skin fetches on the London market from seven dollars to fifteen dollars, according to size and quality.

The Gray Wolf has often been crossed with the domestic dog, and in the North such half-breeds have been utilized in drawing sledge trains. In captivity, according to Dr. Hornaday, they retain all their meanness, treachery, and cruelty. "No matter how well yarded, well fed or comfortable, a Wolf will watch and coax for hours to induce a neighbor in the next cage to thrust through tail or paw, so that he may instantly

seize and chew it off, without mercy." Other observers tell like tales of its treachery.

Mr. Merritt Cary in "A Biological Survey of Colorado," says: "Gray Wolves were formerly abundant over practically the entire State, except possibly the highest mountains, and were especially numerous on the eastern plains, where large bands preyed upon the Buffalo. From this habit of hanging on the flanks of the large herds, they were generally known as Buffalo Wolves. The mountain animals are said to average much darker than those of the plains. Unfortunately, there are no specimens available from the mountains to settle this point, but it is unlikely that two forms occur in the State. Wolves are still found in considerable numbers in North Park and in Routt and Rio Blanco Counties, where they kill a great many range cattle. A few are probably found throughout the mountains west of the main ranges, and small numbers are still present over the more unsettled parts of the eastern plains region, particularly in Baco and eastern Las Animas Counties, in the extreme southeast, where, in 1907 and in 1910, they were said to be common and to kill a great many sheep. In 1906 Wolves were common over most of the Routt County, notwithstanding the bounty of fifteen dollars authorized by the local stock association, the additional ten dollars offered by the county, and the efforts of several professional wolf trappers employed by the association.

"In Dixon, Wyoming, I saw a nearly adult black Wolf in captivity, which had been captured as a cub. This individual was kept in a large cage in the back yard of its owner in Dixon. A boy of three years was petting and stroking its head through the bars, and the Wolf's every movement betokened its pleasure in the companionship of the little fellow. All playfulness immediately left it, however, on the approach of a man, when the wild, untamable wolf nature was revealed in bared fangs, curling lips, and glaring eyes. The mother of this Wolf was gray, as was also one of the three cubs captured in the den."

RED FOX

Vulpes fulva (*Desmarest*)

Other Names.— See Remarks.

General Description.— Size of a small dog, total length about 3 feet. Fur long and soft. Tail long and bushy. Ears long, erect, pointed. Pupil of eye elliptical. Nose elongate and tapering. Color bright yellowish rufous above, white underneath; feet blackish. Claws long, sharp, non-retractile. Toes, 5 in front, 4 behind.

Dental Formula.— Incisers, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{2-2}{3-3} = 42$.

Pelage.— Adults: Sexes identical. General color above, yellowish brown or bright yellowish rufous, darkest on back and shoulders; throat, middle of belly and undersides of legs white or whitish, often tinged with dusky; front of legs and feet largely brownish black; terminal half of upper surface of ears dark brown; tail yellowish brown more or less tipped with brownish black; tip of tail white. Young: Muzzle blackish; head dusky with sides of face light yellowish and nearly the whole posterior ear black; tail dusky with white tip.

Measurements.—Male about 1/10 larger than female. Length, male, 3 feet; tail, 14½ inches; hind foot, 5¾ inches.

Range.— Northeastern United States.

Food.— Small mammals, birds, frogs, meadow mice, hares, squirrels, poultry.

Remarks.— The Red Fox group is found over practically all of North America from the Atlantic to the Pacific, and from the Arctic Coast south to about 35° on the Atlantic Coast, and on the Pacific Coast, and in the Rocky Mountains to about 38° latitude. This group is made up of some 16 species and subspecies, all differing, in general, from one another in some variation on the color pattern or in size, often rather minor details. Among many of these species color phases or deviations from the normal color pattern appear. These color phases may appear in a litter with all the other members the ordinary red pattern, and are of three styles: the Cross Fox, the commonest of the color "freaks", the Black Fox, or the Silver Fox, the latter two very rare in occurrence. These phases vary from the normal as follows:

Cross Fox.— Body color variable but showing more or less gray and fulvous. A black streak crosses the shoulders and meets at right angles another running down the line of the back, forming in effect, a cross.

Black Fox.— General color black with more or less white tipping to the hairs. Tail with a white tip.

Silver Fox.—Same as Black Fox but with many more white-tipped hairs, giving a frosted appearance.

Related Species

Common, or Eastern Red Fox.—*Vulpes fulva* (Desmarest). The typical form as described above. Northeastern United States.

Nova Scotia Red Fox.— *Vulpes rubricosa rubricosa* (Bangs). Larger and darker in color. Range restricted to Nova Scotia.

Newfoundland Red Fox.—*Vulpes deletrix* Bangs. Color very pale, varying from yellow and buffy to light straw color. Newfoundland.

Royal Red Fox.—*Vulpes regalis* Merriam. Size large, color golden yellow, shading to whitish yellow on face, legs reddish brown. Northern Plains from Dakota to Alberta, east to Manitoba and Minnesota.

Western Red Fox.—*Vulpes macrourus* Baird. Size large; colors rich; tail long. Mountains of Colorado, Utah and Wyoming.

Sierra Red Fox.—*Vulpes necator* Merriam. About size of the common Red Fox. Color throughout rather paler. High Sierra above 6000 feet altitude in California.

Cascade Red Fox.—*Vulpes cascadensis* Merriam. Size greater than that of common Red Fox. Color pale. Cascade mountain system of Washington, Oregon and into the Sierra Nevada of California.

Alaska Red Fox.—*Vulpes alascensis alascensis* Merriam. A large, long-tailed species; color golden fulvous. Northern Alaska.

Columbia Red Fox.—*Vulpes alascensis abietorum* Merriam. Lighter, longer and more slender skull, Interior of British Columbia and southeastern Alaska.

Kodiak Island Red Fox.—*Vulpes harrimani* Merriam. Largest of the Red Foxes; tail enormous, largest on basal fourth, tapering thence to tip. Kodiak Island, Alaska.

Photograph by S. A. Lottridge

RED FOX

Noted ever since the time of Æsop for its cunning, the Red Fox of today lives up to its reputation. It is the arch-schemer and trickster of the animal kingdom

From time immemorial the English Red Fox has been accepted as the embodiment of speed, cunning, and resource; but Dr. M. G. Ellzey, who has hunted the American Red Fox in Virginia, is persuaded "that, as found in the States of Maryland, Virginia, West Virginia, North Carolina, and Tennessee, the American Red Fox is an animal far superior to the English Fox, in speed, endurance, cunning, and resource, when in front of a dangerous pack. He laughs an inferior pack to scorn." In the matter of daring, there is no doubt that he excels his British cousin.

Perhaps a few reminiscences of Fox-hunting will serve, better than anything else, to give those unacquainted with this clever animal clearer notions as to the scope of Fox sagacity. To begin with, it should be borne in mind that Foxes, unless old and experienced in guile, will not, when hounded, run far away on a straight course, but will circle near the home where they were reared. It is also well to know that Foxes have certain runways through valleys and across hills, through swamps and along water courses, and that these are followed more or less regularly by the Fox, either when pursued or when quietly moving from place to place in search of food. This fact is taken advantage of by hunters, and the runway must be located before success in the hunt can be expected.

In the fall of 1880, Foxes were very plentiful in the State of New York on the hills between the Unadilla and Chenango Rivers. There was scarcely any snow until late in November, and when it did come it was very dry, the wind blowing it from the fields and hill tops, and drifting it along the fences. Notwithstanding the bareness of the fields, thoughts of the old-time sport tempted the more adventurous hunters. Two of these enthusiastic Nimrods set forth with a well-trained hound before the snow had stopped sifting about even in the less exposed places. The hound soon struck a trail, and as the track was fresh he seemed to fly over the snow. The deep-toned baying sent the blood tingling through the veins of both pursuer and pursued. The first hunt of the season was really on! The men took positions of vantage on the supposed runway, watching and listening carefully for the expected game. Meanwhile, the hound had gone quite out of hearing to the north. An hour passed and no Fox appeared. Nothing was heard save the baying of the hound far away to the east. In half an hour the Fox appeared in a valley, over which the hunters commanded a distinct view. As the Fox could not take to the water in the frozen streams, he tried another trick which worked admirably. It was this: Within the valley and in sight of the hunters were two ploughed fields, each containing a marked elevation. The wind had swept these higher areas completely bare of snow and loosened bits of earth had rolled away, until the surfaces were quite smooth. The runway of the Fox may have been across these wind-swept places. Be that as it may, the Fox crossed each in turn. When the hound came upon the first place he lost the trail for a time, but finding it, proceeded to the second. The Fox, instead of continuing his course as would naturally be expected, returned to the first by a circuitous route and then again to the second. He repeated this manoeuvre three times, taking the same course each time, finally quitting the game by turning sharply to the left, and making off to the south, leaving behind him a most weary and perplexed dog.

At another time a Fox was seen to follow a rail fence for about forty rods, nearly in the opposite direction from that in which he had been traveling; he then jumped from the fence upon the ice of a small creek. By this ruse he succeeded in completely eluding the hounds.

The common Red Fox is to be found throughout the northeastern United States and Canada, as far south as the Carolinas. Though fond of the open prairies, it is especially partial to districts in which there are low hills and ravines, or where there is close proximity to cover. What may be termed its home range, however, is about five miles in diameter in summer, and probably twice that distance in winter.

The Red Fox takes its name from the rusty or yellowish red color of its coat. The male is a little over three feet in length, the tail being about fourteen inches long. Its height is about thirteen inches. The female is smaller. In northern Foxes the tail is very large, and Mr. Seton gives the following reason for this: "Its nose and pads are the only exposed part, and these might easily be frostbitten when it sleeps during severe weather. But it is always careful on lying down to draw these together, then curl the brush around them; it acts both as wrap and respirator. . . . I believe a Fox or Coyote would die before spring if turned out in the autumn without a tail."

Its hearing is remarkably keen, and it depends upon this more than upon its eyesight.

The Red Fox mates in February or early in March, and it seems to be fairly well established that the animal truly pairs. The male Fox is an attentive husband and brings food to his mate, whom he assists in caring for and feeding the cubs. The young are born about the first of April; there are four to nine cubs in a litter; and they are born in the den or "earth," which is sometimes excavated by the parents and sometimes is an adaptation of a hole that they have found. Besides the den proper, there is often a space used as a store room. The cubs, which are kittenlike in appearance, do not see till the eighth or ninth day from birth, and they remain in the den till they are three or four weeks old. Though nearly full-grown in August or September, the cubs are still to be found with their parents; they scatter, however, before winter.

The speed of the Red Fox is much greater than that of its gray cousin; it has been known to cover a certain distance at the rate of thirty miles an hour. Dr. Ellzey considers "it is doubtful whether a first-rate specimen of a Red Fox, taken at his best in point of condition, can either be killed or run to earth by any pack of hounds living." The Fox has no regular hours for sleeping or eating; it likes to sleep in the sunshine, and, when tired, "lies down for a nap, not usually in a hollow, but on some exposed place, the top of a bank, a boulder, a log, or a stump. . . . He looks like a yellow stone, and seems to know it."

The Red Fox's dietary is both extensive and

varied. For flesh, he partakes of woodchucks, hares, rabbits, and mice, with an occasional young lamb for a change. He has a pronounced fondness for the occupants of henroosts, also partridge, and other ground game. Fish and crabs form other items. Such delicate morsels as frogs and beetles he does not scorn when other food is scarce. He kills large numbers of mice and other destructive rodents, and thus recompenses the farmer to a great extent for the loss of an occasional chicken.

The enemies of the Red Fox are many, Wolves and Lynxes being among the fourfooted ones. Eagles keep a sharp lookout for its young. Fleas are among its pests. It is sometimes subject to rabies. Its extreme age has been estimated at fifteen years.

The fur of the Red Fox is an important article of commerce. In London, in 1912, the number of skins sold by one house alone was 40,300; the total in the previous year having been 58,900. A prime skin is worth ten dollars or more.

Nova Scotia and Newfoundland both have forms of the Red Fox. That of the former is larger and of a brighter rusty red than the common Fox. The Red Fox of Newfoundland is of a paler color and less rusty than the common Fox, with larger hind feet and claws. It is smaller than the common Red Fox.

For other related forms of this numerous and widely scattered tribe see list above. Three important color phases, however, are given further mention below.

CROSS FOX, BLACK FOX, SILVER FOX

The Cross Fox and the Black, or Silver Gray, Fox are merely color phases of the Red Fox, but the importance of the trade in their skins entitles them to separate treatment here. Mr. A. P. Low, in 1887, on the Moose River, Labrador, found a litter containing seven kits. Of these two were Red, three were Cross, and the remaining two Blacks or Silver.

The Cross Fox gets its name from the large cross-mark formed by two dark stripes; one across the shoulders, and the other running down the middle of the back. The color of the tail is darker than that of the Red Fox, and the muzzle, legs, and under parts are black. It has a reddish patch on the side of the neck, and another behind the foreleg. It occurs in British Columbia, Alberta and Manitoba, Alaska, and occasionally in the northwestern States. A first-class dark skin is worth twenty dollars or more.

The Black Fox is a dark edition of the Red Fox. Its general color is jet black. The tail also is black, except the tip, which is white. It is called also the Silver Gray, or Silver Fox, from "the gray rings usually marking the otherwise black hairs of the hinder half of the back, the head, and the thighs, which communicate the peculiar silver luster to the fur."

The fur of the Silver Fox is, next to that of the Sea Otter, the most valuable fur in the world, that is to say, in the present-day fashions, matched skins of good size and texture bringing from $500 to $4,000 each. In the United States, "extra fine" skins have sold for $600 to $1,200 each. The extraordinary prices realized for the furs of this animal have resulted in the establishment of various fox-farms, the center of the Silver Fox fur industry being Prince Edward Island, in the southern part of the Gulf of St. Lawrence. An account of this industry given by Mr. Phil M. Riley in *Country Life in America* (July, 1915), is a valuable contribution to

RED FOX

The fur of this animal is very beautiful, both in color and texture

our knowledge of the Silver Fox; and this fact, combined with the importance of the industry itself, warrants somewhat extensive quotation from this article. Mr. Riley says: "The whole island is virtually a great fur farm, from which the principal income is derived. Of the 2,700 Silver-black Foxes in captivity about 2,500 are there. More recently the breeding industry has been firmly established in a few of the United States along the Canadian boundary, where the climatic conditions have proved to be ideal.

"There are several reasons for preferring furs grown in captivity. Pelts from the wild must be taken when caught, regardless of their condition. . . . Here the breeder has a big advantage over the trapper. Not only may the pelt be taken when the fur is at its best, but by the use of chloroform the killing may be virtually painless and without mutilation. While the trapper may occasionally command top-notch prices, the breeder can do so every time. . . . Another fear that has prevented the establishment of Fox breeding on a firm basis in the United States is that success will attend it only in a bleak northern latitude. The United States Department of Agriculture, however, states that the whole eastern and northern sections of the country as far south as Tennessee, and about all of the Pacific Coast States are suitable for Fox breeding. This is attested by naturalists of the first authority, and has been shown practically in several instances, notably by a large and successfully conducted fur ranch at Whitefield, N. H., of which Otto J. Piehler, of Boston, is president. . . . A 2000 acre tract of land has been purchased in the White Mountain region, embracing three ponds and several streams and mountain peaks, and providing every desirable condition for breeding not only the Fox, but the Mink, Raccoon, Black Muskrat, American Otter, Beaver, and Marten."

In 1910, Silver Fox breeders sold for $4,000 a pair; in 1911, the price jumped to $6,000; in 1912, it became $10,000; in 1913, $15,000; a two-year-old pair that had shown unusual fertility was sold, with a guarantee, for $30,000; and later in the same year the record for guaranteed breeders became $40,000. The Woodbury ranch promises to become famous because of the vigor, stamina, and all-around quality of its breeders. Experts agree that the prime pelts at this ranch for beauty alone would easily bring $2,000 to $3,000, the fur being thick, full, soft, glossy, and of beautiful color sprinkled with white points.

The Silver Fox is monogamous, and the pairing is a matter of utmost delicacy, for both male and female quickly resent uncongenial companionship. This is one of the chief factors in the high cost of mated pairs for breeding purposes. From early in February until June or July, the mated pairs must be unmolested, except by a friendly keeper who goes quietly into the pens with food. The kennels must not be approached or any attempt made to count the litters. Plenty of sleep, quiet, and contented solitude are needed during this period, for the mother is ever quivering with anxiety for the safety of her charges. So great is her love for them that if she fears intrusion or interference, she will kill them that they may be spared from what she evidently fears may be a worse fate.

"The young feed on the mother's milk, but occasionally, if the mother ignores them, they are weaned easily, for they will take milk and crackers as freely as a child. For cubs open their eyes in about three weeks after birth, after which there is less danger. . . . Also for variety of food, fish, fruit, small game, and crickets may be employed; hard tack and ordinary sea or dog biscuit dipped in fresh milk are desirable. Bannock or unleavened bread, shortened with tallow, is often used, and fresh grass is desirable as a laxative. . . . Full feeding for a few weeks helps to make the fur glossy. Some breeders employ honey, molasses, or patent stock food for the same purpose. The cost of feeding a Fox is estimated at ten dollars to fifteen dollars a year, and two men are ample for care and constant watching on a ranch where there are forty to sixty foxes."

Dr. William Young Chapman, writing under the title "Fox Frenzy" in the *Independent* (February 13, 1913), says: "Recently, one of the pioneers in the (fox-breeding) business sold his ranch of twenty pairs to a company, with certain guarantees, for $625,000, and within a few weeks a gentleman from Russia visited 'The Island' and purchased five pairs for $100,000. These are to be shipped to Russia and the industry will be established in that country."

KIT FOX

Vulpes velox (*Say*)

Other Names.— Swift Fox, Long-eared Fox.

General Description.— See general description of Red Fox. A diminutive Fox similar in form and general appearance to the Red Fox. Color much paler; legs shorter. Tail half as long as head and body. No black on ears.

Dental Formula.— Same as that of Red Fox.

Pelage.— Top of head, ears, upper part of body and tail yellowish-gray, darkest on back, hairs tipped with white; sides of neck, flanks and upper portion of legs buffy white, inclining to rufous where it meets the gray of upper parts; a black patch on each side of muzzle, some hairs white-tipped; under parts and legs white; under side of tail buff, tip black.

Measurements.— Length, 25½ inches; tail, 9 inches; hind foot, 3¾ inches. Weight, 4 pounds.

Range.— Plains of Colorado and Nebraska to Saskatchewan. A prairie dweller.

Food.— Small mammals and birds of the region it inhabits.

Remarks.— This is the smallest member of the Red Fox genus. The sub-group to which this Fox belongs differs rather markedly from the other members of the genus in appearance, habitat (dwelling in the open) and consequently somewhat in habits. The color phases of the typical Red Fox group are unknown among the Kit Foxes. The Kit Foxes might be considered as Red Foxes that had left the timbered regions to dwell in open, semi-arid areas and had become bleached out by exposure to the hot sun, as well as suffering a reduction in size.

Related Species

Kit, or Swift Fox.— *Vulpes velox velox* (Say). The typical form of the description above. Plains and prairies from Colorado and Nebraska to Saskatchewan Assiniboia.

Merriam's Kit Fox.— *Vulpes velox hebes* Merriam. Larger; paler and grayer. Alberta.

Long-eared Fox.— *Vulpes macrotis* Merriam. Size larger; ears very large; color very pale. Deserts of southern California.

The Kit, or Swift Fox, sometimes called also the Burrowing Fox, is a much smaller animal than the Red and Gray Foxes; indeed it is the smallest (also, in the opinion of some, the prettiest) of all American Foxes. It is found from Nebraska to Colorado and northward over the plains. It derives its specific name, *velox*, from its supposed swiftness of foot; but according to several observers, its speed does not justify the appellation. Mr. Seton ranks its speed as "a little higher than the Coyote." It is only about twenty-five inches long, its form being compact and slender. It stands lower than the Red Fox, and its thickly furred ears are relatively longer. Its feet are clothed with long woolly hairs. Its weight is about four pounds. Its under fur is both long and abundant.

The Kit shows the least cunning of all American Foxes. It is very unsuspicious; and its rapid decline in numbers may be due to the readiness with which it eats poisoned meat that has been put out for Coyotes.

The name "Burrowing Fox" has been given to the animal on account of the skill and speed with which it digs its burrows. From these it seldom ventures far.

Kit Foxes feed on birds and their eggs, insects, and small rodents; and they have been seen to catch prairie-chickens that were asleep in soft snowdrifts. From mating time the male and female remain together the summer through; and from the fact that the former is active in the care of the cubs it has been thought that the pairing is permanent. Comparatively little, however, can be stated with certainty concerning this part of Kit Fox life. The Kit's den is often some distance below the surface of the ground. One that was found on Pawnee Creek, Colorado, by one of Mr. Seton's guides, "was reached by a tunnel about nine feet long and was five feet from the surface. The chamber was nicely lined with grass and contained five young ones. 'Just the cutest, prettiest things he ever saw.'"

Adult Kit Foxes are not entirely devoid of strategy, although they are not, as has been stated above, so cunning as some of the other species. Thus if the old and young are together when surprised, the parents will attract the attention of the dog while the cubs make their escape into the burrow.

Though young Kit Foxes may be easily raised, they do not seem to become really tame. This, at any rate, was the case with the five cubs from Pawnee Creek, referred to above, but Mr. Seton says that this Fox is easily managed and breeds freely in captivity, and he cites Audubon and Bachman's account of a captive specimen that "drank more water than Foxes generally do, seemed anxious to play or wash in the cup which held his supply, and would frequently turn it over, spilling the water on the floor of his cage."

The Kit Fox's skin is not commercially valuable, bringing from thirty cents to one dollar and thirty-two cents. In 1912, one firm in London sold 35,222 skins, which was an average annual sale.

ARCTIC FOX

Alopex lagopus innuitus (*Merriam*)

Other Names.— Blue Fox, White Fox.

General Description.— A small Fox with thick, bushy tail, pelage changing to white in winter. Form of body in all essential details as in Red Fox. Hair long and fine.

Dental Formula.— Same as given for Red Fox.

Pelage.— ADULTS: *Summer.* Head and upper parts, flanks and outside of legs slate brown, under parts and inside of legs dingy white; tail brownish above, white below, tip white. *Winter.* All pure white.

Measurements.— Sexes practically equal. Length, 30 inches; tail, 10 inches; heel to end of claw, 4½ inches.

Range.— Alaska, from Point Barrow southward. An inhabitant of Arctic regions.

Food.— Principally lemmings, meadow mice, Arctic hares and ptarmigan.

Remarks.— Although for a long time considered as a member of the same genus as the Red Fox, *Vulpes*, the Arctic Fox is now generally considered as being sufficiently distinctive to be a genus by himself. All the members of this genus are very much alike, the main differences being in cranial characters and in size. As all turn white in winter there is no opportunity for any variation in the winter pelage. The Blue Fox is a color phase of the Arctic Fox, and is analogous to the silver phase of the Red Fox.

RELATED SPECIES

Alaska Arctic Fox.— *Alopex lagopus innuitus* (Merriam). The typical North American form, the animal of the above description. Point Barrow, Alaska, southward and eastward in Arctic America.

Ungava Arctic Fox.— *Alopex lagopus ungava* (Merriam). Slightly larger; cranial differences. Ungava, Canada.

Pribilof Arctic Fox.— *Alopex pribilofensis* (Merriam). Largest of the Arctic Foxes. St. George Island and St. Paul Island, Bering Sea.

Hall Island Arctic Fox.— *Alopex hallensis* (Merriam). Skull shorter and broader. Hall Island, Bering Sea.

"The Fox with a good reputation" would be a good designation for this member of the Fox family. All the naturalists and many others who have come in contact with it have a good word to say for the Arctic Fox. Mr. Witmer Stone says: "The Arctic Fox is in many ways the most attractive of its race, being wholly free from the rank odor characteristic of the other Foxes. . . . In its family life it is certainly the equal, if not indeed the superior, of many of

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ARCTIC FOX

This photograph gives a good idea of the extremely soft and rich coat of the Arctic Fox, during the winter months

the native Eskimo tribes inhabiting the same region, at least in matter of forethought, cleverness, and morality." It is found throughout most of the Arctic regions, and as far south as latitude 50°.

The three color varieties of the animal are so distinct that the mistake has not infrequently been made of regarding them as different species. In the Pribilof Islands, and the Aleutian Archipelago, it has the dull blue tint all the year round; farther north, it is bluish brown in summer and white in winter; still farther north, it is always pure white. Its nose is black-tipped and somewhat of the "stub" variety, and its ears have a cropped appearance, being shorter and more rounded than those of any other Fox.

ARCTIC FOX

Three color variations of the same animal. In summer it is slate brown; in fall it is of mottled appearance; and in winter it is pure white

Its eye, which is hazel in color, is very bright and intelligent.

Arctic Foxes, like Prairie Dogs, live in communities, digging for themselves burrows, of which twenty or thirty are usually to be found together. They are fully as provident as Squirrels in storing up food for the winter, relying mainly upon lemmings. These the Arctic Foxes catch in the swamps or dig out of their holes. This Fox "hunts diligently while game is yet abundant, and brings home load after load of fat-bodied lemmings to be packed away in cold storage for the winter. Where the Blue Fox lives the frost never wholly leaves the ground; so he digs down in the moist turf until he reaches a temperature only just above freezing, and packs down several dozen lemmings in a place, covering them with moss and sods. These caches of frozen lemmings are his principal food supply for the greater part of the year." It will happen sometimes that these caches are opened by the Wolverines and Wolves, which are the worst enemies of the Arctic Fox.

During the short summer the Arctic Fox has a great variety of food and plenty of it. He is a terror to the different kinds of birds, especially breeding waterfowl, not only preying on the birds themselves, but also robbing their nests. He is partial to polar hares also, but catching these is no easy matter. When the first young seals are born, numbers of Arctic Foxes move seaward and find their food on the coastal ice.

According to Richardson, the Foxes of the northern portion of Arctic America migrate southward, the line of march being always as near as possible to the coasts. Some hunters, however, affirm that it is only the young Foxes which have not "set up housekeeping" that go south; and that these kill their food as they go, returning when daylight lengthens and the sun reappears across the south, to rejoin the older Foxes.

The Blue pelts are by far the more valuable, selling from $125 to $250. On St. George's Island, one of the Pribilof group, 250 pairs of Blue Foxes are kept for breeding purposes. Mr. James Judge, writing in *Science*, gives some interesting information concerning these Foxes. The mating season, he says, is March and the first half of April; and, contrary to the often heard statement that this Fox truly pairs, only one authenticated instance of pairing has been recorded on St. George's Island. The average weight of the males is a little under eleven pounds; that of the females, eight and three-

quarter pounds. There are five to twelve cubs in a litter, and they are born in May or early in June. Occasionally there is a white cub in a litter. The cubs weigh about two and one-half ounces each, and their eyes open on the fifteenth day from birth. Only about two cubs per female reach maturity. Since 1896, all seal meat not used by the natives of the island has been salted and fed to the Foxes the following winter.

On various other islands along the Alaskan coasts some forty or fifty firms are engaged in Blue Fox breeding, and White Fox farming has become an important industry in Nova Scotia, New Brunswick and Quebec.

The Arctic Fox does well in captivity, and, according to Dr. Hornaday, is "ever ready to adopt the prepared food of civilization." It is a graceful and attractive little animal that repays closer acquaintance for its own sake as well as the value of its coat.

GRAY FOX

Urocyon cinereoargenteus *(Schreber)*

General Description.— The eastern Gray Fox is of medium size with moderately long hair and long bushy tail. Pupils of eyes elliptical; tail with concealed mane of stiff black hairs on its upper surface; skull with widely separate temporal crests; muzzle short. Color above silver gray, beneath white. Hair coarser than that of Red Fox.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{2-2}{3-3}$=42.

Pelage.— ADULTS: Sexes similar. General color of back and sides grayish-white; sides of neck and a band across the chest red-brown; ears, inner surface of legs, sides of belly and under surface of tail also more or less red-brown, the extent and intensity of the color variable. Throat and greater portion of belly whitish; sides of nose and under jaw blackish; a ridge of black hairs extend down middle of tail above. YOUNG: Pups have muzzle blackish, head grayish; back of ears fulvous basally, tipped with dusky; tail black tipped.

Measurements.— Sexes nearly equal. Length, 35 inches; tail, 11½ inches; hind foot, 5¼ inches. Weight, 8 pounds.

Range.— New York and New Jersey to Georgia, west to the Mississippi Valley, and north to north central Illinois.

Food.— Mice, rabbits, squirrels, birds, eggs, reptiles, insects and various berries.

Remarks.— This animal is not to be confused through similarity of names with the Silver Gray Fox (*Vulpes fulva*) from which it differs considerably. Authorities have separated the Gray Foxes into no less than 14 species and subspecies to be found north of the Rio Grande. As the basis of many of these separations are with difficulty discernible to the layman no attempt is made to list all the related forms, only the principal ones being mentioned.

RELATED SPECIES

Eastern Gray Fox.— *Urocyon cinereoargenteus cinereoargenteus* (Schreber). The animal described above. Eastern North America from Georgia north to New England, west to Mississippi Valley.

Florida Gray Fox.— *Urocyon cinereoargenteus floridanus* Rhoads. Size small; pelage harsher; tail and ears shorter. Florida to Georgia.

Scott's Gray Fox.— *Urocyon cinereoargenteus scotti* (Mearns). Longer ears and tail than the typical form; colors paler. Southern California, Arizona and western New Mexico.

Wisconsin Gray Fox.— *Urocyon cinereoargenteus ocythous* Bangs. Larger in size; tail longer; less gray, more yellowish. Upper Mississippi Valley.

Desert Gray Fox.— *Urocyon cinereoargenteus texensis* Mearns. Paler than the Eastern Gray Fox; ears longer; tail longer. Texas.

California Gray Fox.— *Urocyon californicus californicus* (Mearns). Paler, lacking black on fore legs. Ears much longer. California to Washington.

Santa Barbara Gray Fox.— *Urocyon littoralis littoralis* (Baird). Smallest of the Gray Foxes; weight about 4½ pounds. Color similar to California Gray Fox. San Miguel Island, Santa Barbara Islands, California.

The Gray Fox differs from its red cousin in color and size. It is not to be confused with the Silver Gray Fox, which is an animal of widely differing traits. Of the common Gray Fox there are at least fourteen species, the most important being listed above.

The male and female are nearly of the same size, being about three feet long, and with tails nearly a foot long.

The Gray Fox is common to almost every State of the Union, although in some sections persistent hunting or the growth of towns has

By permission of the New York Zoological Society

EASTERN RED FOX

An animal common to the northeastern part of the United States, but with relatives scattered throughout the West

made it scarce. The Eastern Gray Fox ranges naturally from New England to the Mississippi Valley. In Florida, there is a smaller cousin. In Wisconsin, a larger one, marked with more yellow. In California, there are several species. It will thus be seen how much at home Gray Jacket has made himself.

Dr. Ellzey, when contrasting the habits of the Gray Fox with the Red, observes that the two animals differ very widely. "So far as my personal observations inform me," he says, "the following are some of the principal distinctions. First, as to reproduction, the Red Fox nearly always brings forth its young in an earth den, the Gray Fox generally in a hollow log or tree or, at most, under a rock. I have seldom seen a Gray with more than five, and often with only four young. I have never seen a Red with less than five. I have seen one with nine, and several with seven. I think it certain, therefore, that the Reds are more prolific. Second, as to hunting for prey and subsistence. The Reds are bolder in pursuit, and hunt over a much greater territory than the Grays. Whether the Grays ever climb trees in pursuit of prey I am uncertain, but they take to a tree as readily as a cat when run hard by hounds. I think it nearly certain that they climb for persimmons and grapes. Red Foxes never climb trees under any circumstances; when hard run they go to the earth. Gray Foxes run before hounds only a short distance, doubling constantly and for a short time, when they either hole in a tree, or climb one. I have known the Red Fox to run straight away nearly twenty miles. Very commonly they run eight or ten miles away, and then run back in a parallel course. I have known them to run the four sides of a quadrilateral nine or ten miles long by about two miles broad. It is doubtful whether a first-rate specimen of the Red Fox, taken at his best in point of condition, can either be killed or run to earth by any pack of hounds living, such are his matchless speed and endurance. It is but a sorry pack which fails to kill or tree a Gray Fox in an hour's run. The young of the Gray Fox closely resemble small blackish puppies; those of the Red Fox are distinctly vulpine in physiognomy when only a few hours old."

Photograph by Daniel J. Singer

DESERT GRAY FOX

A desert-loving animal which frequently makes its home in a rocky den

"The Fox from its occasional misdeeds," says Dr. A. K. Fisher, "is looked upon by the majority of mankind as a deep-dyed villain that devotes its entire life to robbery and derives its forage from the chicken yard or duck pen. As a matter of fact, within the localities where Foxes are abundant, it is comparatively rare that poultry is destroyed by them. On all well regulated farms, chickens are housed at night, and the Fox necessarily turns his attention to field mice, rabbits, ground squirrels, and insects,

such as grasshoppers, crickets, and May beetles to the great benefit of the farmer. Although it is true that the Fox destroys a considerable number of birds, yet a Ruffed Grouse has been known to rear its young within 100 feet of a Fox den, and the tracks of the young birds have repeatedly been seen on the fresh earth before the entrance. Among the food brought to the young in its litter and left outside were rabbits, mice and other smaller rodents, and half-grown woodchuck, but no birds of any kind."

EASTERN GRAY FOX

This animal is sometimes called the "tree fox" because he does not hesitate to climb trees, either to escape pursuit, or to hunt food — perhaps a nice young squirrel, or fruit or nuts. He is not hard to please

STRANGE COMPANY

Two Polar Bears and a Brown Bear fraternizing together in a menagerie

THE BEAR FAMILY

(*Ursidæ*)

BEARS comprise one of the most distinctly marked families of all the Carnivores. No one familiar with animals could see a Bear even at a distance and fail to recognize it. While the Bears may differ widely in size and coloring in various countries, the same general traits are peculiar to all. They are heavy lumbering animals, treading solidly upon their feet. In some species they grow to immense size, some of the largest being found in North America. They are, indeed, the largest of our Carnivores.

The skull of the Bear is heavy and elongated, the back portion being especially heavy, and the jaws powerfully hinged. The teeth are true molars with broad flat crowns. The soles of the feet are naked, the feet are plantigrade, and the tail short.

The members of the Bear family are characterized by their heavy and massive build, their thick limbs, extremely short tails, and the presence of five toes armed with powerful claws, on both the fore and hind feet. Moreover, when walking, the whole sole of the foot is applied to the ground in the heavy plantigrade manner, so that the impression of a bear's foot presents a considerable superficial resemblance to that of a man. The claws of the feet are incapable of being retracted, and are well adapted for digging, although no members of the family are in the habit of constructing burrows for themselves after the manner of foxes.

The various members of the family have a marked resemblance to one another, so that the characters by which the different species are distinguished are slight. Their fur is coarse, and generally long, thick, and shaggy, although it may be short and thin in some of the tropical species. Except for an occasional white collar round the throat, the fur is nearly always of one color, and generally some shade of either brown or black. It is true, indeed, that the Polar Bear is a marked exception to this rule, but in this case the color of the fur has evidently been specially modified to suit the natural surroundings. The great prevalence of black among the Bears is a feature unknown in any other group of Carnivores, and is, indeed, rare among Mammals in general.

Bears have a wide geographical distribution, occurring throughout Europe, Asia, and North America, while one species inhabits the South American Andes, and another the African Atlas. South, however, of the Atlas not a single member of the family is to be found throughout the length and breadth of Africa. Geologically speaking, true Bears, that is to say those which can be referred to the genera now living, are of comparatively recent origin, none being yet known before the Pliocene, while it is not till the succeeding period that they become abundant.

POLAR BEAR

Thalarctos maritimus *Knottnerus-Meyer*

Other Name.—White Bear.

General Description.— One of the largest of Bears, reaching a length of 10 to 11 feet. Color whitish to yellowish white. Neck elongate. Soles of feet hairy with small bald pads. Forehead nearly on line with nose. Head long. Molar teeth small and narrow. Tail very short.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{2-2}{3-3} = 42$.

Pelage.— Sexes similar; young like adults. Color white at all seasons; sometimes portions of the pelage tinged with yellow or saffron. Hair long, soft and very dense, especially in winter.

Measurements.— Length, male, 8½ to 11 feet; height at shoulder, 4½ feet; weight, 1000 to 1500 pounds, but latter figure seldom attained. Female generally smaller.

Range.— Arctic regions of the world.

Food.— Seals, fish and any animal food it may catch.

Remarks.— This Bear may be known at once by its unique color as well as its long neck and body. The form described above is the typical animal of the Arctic regions, and by some authorities it is considered that there is only one Polar Bear in all the Arctic regions. By others the American Polar Bear is considered a distinct animal, and, in fact, no less than three different forms have been described from America. All of these, however, differ in no marked characters from the above, but for the sake of completeness they are listed below.

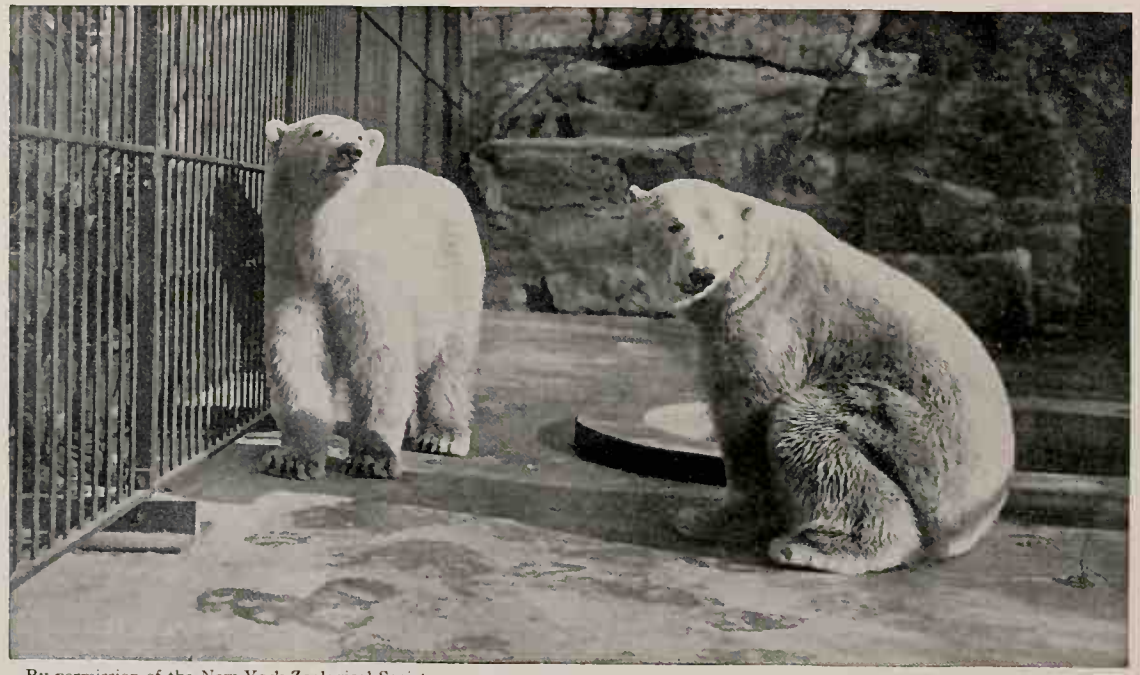
RELATED SPECIES

Ungava Polar Bear.— *Thalarctos maritimus ungavensis* Knottnerus-Meyer. Typical animal of above description. Ungava, Canada.

Greenland Polar Bear.— *Thalarctos eogroenlandicus* Knottnerus-Meyer. Greenland.

Labrador Polar Bear.— *Thalarctos labradorensis* Knottnerus-Meyer. Labrador.

The Polar Bear, whether wild or in captivity, is one of the most interesting members of the Bear family. In its native state an inhabitant of the vast solitudes of the Far North, hunting its prey over snowfields and glaciers or in icy waters, it nevertheless bears confinement well, and has become a familiar object in our zoological collections, of which it always proves an attractive feature. Usually regarded as scarce in comparison with other species of Bear, the Polar Bear is probably more numerous than is generally supposed. On a lone island in the northern part of Bering Sea there were found in the latter part of the last century between 250 and 300 Polar Bears, twenty being in view at one time; and it is reasonable to conclude that in the immense inaccessible regions of the Arctic, where the animal can breed unmolested, there must be large numbers that pass their existence unknown to and undisturbed by their chief — one might say, their only enemy — man.



By permission of the New York Zoological Society

POLAR BEARS

Two half-grown cubs trying to keep cool in the Zoological Park, New York. Their coats, if frequently washed, are almost pure white

The Polar Bear is equally at home on land or in water. Its hair-covered soles enable it to retain a firm footing on the most slippery surfaces; and it has been seen to watch from a projecting piece of ice an unsuspecting seal sunning itself on a ledge below, then suddenly to shoot on to the head of its victim, knocking the latter into the water, where it became an easy prey. It is far and away the most powerful

swimmer of the bear family. It has been met with in the open sea forty miles from the nearest shore, and Peary saw the tracks of one, along the course of a lead covered with young ice, more than 200 miles from land.

Another remarkable fact recently discovered is that the Polar Bear swims entirely with its forelegs, the hindpart of its body being well down in the water. It is possibly the only quadruped which swims in this fashion.

Like all Bears, the Polar Bear has poor eyesight, and relies mainly on its nose for scouting. Its sense of smell is very keen, and it can readily detect the presence of concealed food on land and of fish in a harbor. It is very fond of pork, especially fat pork; and Felix Riesenberg, who had a hunting camp on the shores of Virgo Haven, opposite the old Andree base, thus relates how the odor of roast ham once brought an inquisitive Bruin to his death:

"Morton, who was the official chef, busied himself in an attempt to roast some pieces of ham over the glowing coals, while Paul and I sat impatiently by, awaiting the completion of the dainty morsels and ready to sandwich them between pieces of hardtack. On the stove we had a pot of coffee steaming merrily. At the conclusion of this modest refreshment we proposed to crawl into our bags.

"The noise of sharp claws against a roof of frozen tar-paper is peculiar, and the thud of a heavy body launched from nowhere and scratching its way over your lonely housetop away up in the Arctic regions is, to say the least, diverting. These sounds rasped upon us just as we were about to draw our toes up to the fire for a smoke, and the thrill sent through our little party was electric. 'A Bear! A Bear!' we all shouted together, grabbing our rifles and rushing blindly out into the night. . . . I sent two shots after a big white fellow in full retreat over the snow.

"The bear had carefully nosed his way up on top of the slanting roof of the lean-to, and on up to the smoking chimney whence came the appetizing odor of roast ham. Evidently a whiff of smoke had caused him to lose his balance, and he slid backward, scratching with all his might to hold his footing.

POLAR BEAR AT HOME

The floating ice that forms this Polar Bear's couch is just to his liking

"Roast ham proving a tempting bait for Bear, we kept our surplus pork trimming sizzling in the stove for many days."

At length the Bear came back, and this time received his quietus from the rifles of the party.

The flesh of the Polar Bear is welcome food for the hunter; its teeth and claws are used as ornaments; its fat furnishes the Bear's grease of commerce; and its pelt serves as material for garments for the Eskimos and is mounted in the form of robes and rugs. A fine specimen of the latter has been known to fetch $1,000 in New York.

Both Carl Hagenbeck and J. W. Bostock, the well-known animal trainers, agree that the Polar Bear is harder to train than any other kind of Bear. The former says that "at certain seasons of the year they become extraordinarily restless and intractable," and the latter, that

" even in cold and frosty weather, a Polar Bear, when being trained, will get completely played out long before any ordinary Bear would consider he had begun."

J. Alden Loring, who studied the antics of two Polar Bears which for ten years were exhibited in the New York Zoological Park, bears testimony to the genuinely playful disposition of the animals. They would amuse themselves for hours with an airtight beer-keg, which they would force under the water in their swimming-tank when it came to the surface, much as a child would keep a rubber ball bouncing on the sidewalk; they engaged in bona-fide wrestling bouts; and one was a very good juggler with a piece of bone, which he would throw up into the air with evident enjoyment.

Most of the Polar Bears now shown in the menageries and zoological parks were captured when young, but a few years ago Paul J. Rainey succeeded in bringing from the Arctic a full-grown male. This was such a difficult, hazardous, and noteworthy undertaking that some account of it may well be given place here. The first Bear captured, being noosed round the neck, was strangled in being hauled to the deck of the ship. Of the second and successful capture, Mr. Rainey writes in the *New York Zoological Society's Bulletin:*

" On Thursday, August 4th, we sighted a large Bear that the Eskimos took to be a female, but which proved to be the large male Bear now in the New York Zoological Park, swimming among the small broken pans. We lowered the launch and started after him. . . . Finally we succeeded in cutting him off by running between him and the pan for which he was making. . . . He dove, came up alongside, and smashed the boat a terrible blow.

" The Bear seemed to have an idea of getting into the launch, and we had to punch him away with the boathook. Finally we succeeded in roping him, and this time I took good care to leave the rope slack until he had put his forelegs through it, when I took a turn with our end of the rope just as the Bear was busy climbing out on the ice. . . . It was a wonderful sight to see this enormous brute with a strong rope just behind his fore shoulders. He would rear on his hind legs, bite at the rope, and jump up and down; but . . . we steadily and surely dragged him towards the edge. Finally, seeing that the inevitable was coming, with a vicious growl, he plunged into the water. . . . We towed him to the ship, swung out the crane, fastened the hook on to the rope, and in the twinkling of an eye Mr. Green, the mate, had hoisted him high into the air and swung him over the ship's deck."

After several attempts to demolish the cage in which he had been placed, in consequence of which a sailor was set to watch the Bear day

Photograph by J. W. McLellan

AN ANGRY POLAR BEAR

The Polar Bear is not the heavy, inactive animal that he appears to be. He can swim and dive nearly as well as the seal, and climbs icebergs rapidly

and night, the animal reached City Island, where he was unloaded by men from the neighboring Zoological Park.

When the first voyagers went to the Arctic Seas, dressed in thick clothes and skins, the Polar Bears took them for seals. On Bear Island, below Spitzbergen, a Dutch sailor sat down on the snow to rest. A Bear walked up behind him, and seized and crushed his head, evidently not in the least aware of what kind of animal it had stalked. When the Jackson-Harmsworth Exposition was wintering in Franz-Josef Land, the Bears were a positive nuisance. They were not afraid of man, and used to come round the huts at all hours. The men shot so many of them that they formed a valuable article of food for the dogs.

The power of these Bears in the water is wonderful; though so bulky, they are as light as a cork when swimming, and their strong, broad feet are first-class paddles. The manoeuvres of a Polar Bear in the water are marvelous to watch. It swims, dives, rolls over and over, catches seals or fish, or plays both on and under the water with an ease and evident enjoyment which show that it is in its element. A favorite game is to lie on its back in the water, and then to catch hold of its hind toes with its fore feet, when it resembles a half-rolled hedgehog of gigantic size. It then rolls over and over in the water like a revolving cask. Its footsteps are absolutely noiseless, as the claws are shorter than the land-bear's, and more muffled in fur. This noiseless power of approach is very necessary when it has to catch such wary creatures as basking seals. A very large proportion of the food formerly eaten by Ice Bears in summer was probably putrid, as they were always supplied with a quantity of the refuse carcasses of whales and seals left by the whaling-ships. This may account for the bad results to the sailors who ate the Bears' flesh. Now the whaling industry is so little pursued that the Bears have to catch their dinners for themselves, and eat fresh food.

The Arctic explorer Nordenskjold saw much of these bears on his voyage, and left us what is perhaps the best description of their attempts to stalk men, mistaking them for other animals. "When the Polar Bear observes a man," he writes in his "Voyage of the Vega," "he commonly approaches him as a possible prey, with supple movements and a hundred zigzag bends, in order to conceal the direction he means to take and to prevent the man feeling frightened. During his approach he often climbs up on to blocks of ice, or raises himself on his hind legs, in order to get a more extensive view. If he thinks he has to do with a seal, he creeps or trails himself forward on the ice, and is then said to conceal with his fore paws the only part of his body that contrasts with the snow — his large, black nose. If the man keeps quite still, the Bear comes in this way so near that it can be shot at the distance of two gun-lengths, or killed with a lance, which the hunter considers safer." When hunting seals, Polar Bears will chase them in the water as an Otter does a fish, but with what result is not known. Besides stalking them in the manner described above, they will mark the place at which seals are basking on the rim of an ice-floe, and then dive, and come up just at the spot where the seal would naturally drop into the water.

GRIZZLY BEAR

Ursus horribilis *Ord*

Other Name.— Silver-tip Bear.

General Description.— Among the largest of the Bears, powerfully built, heavy, thick set. Five well developed toes on each foot; plantigrade; claws long, nearly straight, nonretractile; claws on front foot longer than those on hind foot; tail very short; ears short, rounded; color everywhere dark; generally of a deep brown color grizzled or frosted with white tipping to the hairs.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{2-2}{3-3}$=42.

Pelage.— Sexes alike in color with little seasonal variation. In general color deep brown darkening to brownish-black along spine, on limbs and on ears; occasionally white tipping much reduced; limbs dark, sometimes whitish areas on face or chest. Hair everywhere rather long; generally a short mane on shoulders and upper back, and hair at base of jaws somewhat elongated. YOUNG: Dark in color, similar to adults.

Measurements.— Length, male, 8 to 9 feet; height at shoulder, 3½ to 4 feet; hind foot, 10 inches; claws, 4 to 6 inches. Weight, 600 to 800 pounds. Female, slightly smaller, weighing 500 pounds.

Range.— Wyoming to Alaska in Rocky Mountain region.

Food.—More or less omnivorous, but at times largely carnivorous when opportunity affords; able to prey on the largest, but not disdaining to eat small mammals, such as ground squirrels and gophers.

Remarks.— The Grizzly Bears comprise several species, and they in turn are related rather closely to the group of Bears known as the Big Brown Bear of northern distribution. The line between these groups is not a very hard and fast one, and the classification of the large Bears has been so shrouded in confusion that no two authorities are agreed as to their exact status. In general the grizzlies may be said to inhabit the country from Mexico through the mountain ranges to Alaska, where their habitat overlaps that of the Big Brown Bears. The principal variations in the grizzly group are size and slight color differences, while some importance attaches to cranial marks.

RELATED SPECIES

Silver-tip Grizzly.—*Ursus horribilis horribilis* Ord. Typical form described above. Wyoming to Alaska.

Sonora Grizzly.— *Ursus horribilis horriaeus* Baird. Main differences to be found in the skull. Mountains of New Mexico, Arizona, Colorado, Utah.

California Grizzly.— *Ursus horribilis californicus* Merriam. Largest of the *horribilis* group, and with little silver tipping to the hairs. California.

Alaska Grizzly.— *Ursus horribilis alascensis* Merriam. Size very large. Found in the Norton Sound region, Alaska.

The Grizzly Bear occupies a unique position in the history of the fauna of the North American Continent. From the times when the Indians (never in less than parties of six or eight) attacked it with bows and arrows, down to the present era of the breechloader and magazine rifle, it has stood, in public estimation, as the embodiment of all that is ferocious and terrible among big game animals.

The Grizzly has certainly been more misrepresented than any other member of the Bear family. He has been discredited with the practice of hugging his victim to death; he has been accused of feasting upon mules; and one *quasi*

Photograph by J. M. Johnson

GRIZZLY BEAR

Calmly surveying the intruder of its home, in Yellowstone Park

authority states: "He will climb a fruit-tree, strip whole branches of ripe fruit with his huge paws and claws, and then on the way home will finish off the meal with a toad or a lizard." Mr. William H. Wright cites a State Senator who "tells of shooting a Grizzly four times through the heart and having it still chase him over down timber and bad going," and of another "that used to come once a week, climb a live-oak tree, walk out along a horizontal branch over a high-fenced pigpen, drop in, steal a little pig, push the gate open (it opened out), and go home." Dr. Hornaday, who has made many observations on the temper of the Grizzly, is "convinced that naturally the disposition of this reputedly savage creature is rather peaceful and good-natured. At the same time, however, no animal is more prompt to resent an affront or injury, or punish an offender. The Grizzly temper is defensive, not aggressive; and, unless the animal is cornered, or *thinks he is cornered,* he always flees from man."

Less than a quarter of a century ago, the range of the Grizzly Bear was given by naturalists as from Norton Sound, Alaska, through the Rocky Mountains to Mexico, and from the Pacific Coast across the Sierra Nevada to Wyoming; but this is now considerably diminished, and as late as 1903, it was stated that "in all parts of the United States save the Yellowstone Park and the Clearwater Mountains of Idaho, the Grizzly is now a rare animal, and so difficult to find that it is almost useless to seek it this side of British Columbia . . . in a short time none will exist in the United States outside of the Yellowstone Park and the zoological gardens. In the wilds of Alaska, they may survive for perhaps a quarter of a century longer."

Compared with the Black Bear, the Grizzly has a greater length of body, and is straighter along the back. The muzzle is rather square, the jaws are longer, and the forehead narrower. Another characteristic of the Grizzly is the great length of the third incisor on each side of the upper jaw. Dr. W. S. Rainsford once killed "two well-grown two-year-old Grizzlies together, who had double instead of single tusks, in both upper and lower jaws." It has very powerful shoulders, and over these in some members of the group is a hump-like lift which hunters term the "roach." Its claws are from four to six inches long and very formidable; and, while they do not enable the animal to climb a tree, they are admirably adapted for digging roots, turning over rocks or logs, and especially for fighting. A Grizzly has been known to carry off the carcass of an Elk weighing nearly 1000 pounds.

The published accounts of the size and weight of the Grizzly Bear are, in many cases, very misleading and much exaggerated. Mr. Wright, who has hunted, studied, or photographed the animal for twenty-five years, has seen old Grizzlies, with "their teeth worn down to the gums," that would not have tipped the scales at more than 250 or 300 pounds. Dr. Rainsford estimated the largest of eighteen Grizzlies killed by him at not more than 850 pounds. Mr. Wright saw one in Spokane that had been "sold to a butcher, who claimed that he weighed it and paid for 1173 pounds of bear meat."

With regard to color, Grizzlies show considerable variety. As long ago as 1805, Lewis and Clark in their journals described them as "grizzly," "gray," "white," "brown," and "variegated." Dr. Rainsford considers that all varieties of color are accounted for by the established fact of interbreeding; he himself "shot three young Bears going with one sow, one almost yellow, one almost black, and another nearly gray." Dr. Hornaday does not "know of any other Bear species in which the coloration of the pelage is so erratic." The standard color (in winter) is brown next to the skin, the extremities of the hair being tipped with silvery gray, from which has come the common name of "Silver-tip."

It is difficult to describe the gait of a Grizzly. His walk is a shuffle but he will go a very long way without breaking it; his run is a mixture of a lope and a gallop; and "no man can match him in speed, and it takes a mighty good horse to catch him."

The feeding habits of the Grizzly Bear depend on his environment. In a good Elk country he will feed on the carcass of that animal; in the Clearwater region he forsakes this diet, and subsists on grass, salmon — he is a skillful fisherman — and ants, grubs, or larvæ. When the berries come round, he feeds on them; later, on salmon again, and once more on ants.

Grizzly Bears mate in the Northwest about the middle of June to August, and begin to hibernate in November, but these times vary somewhat in different regions. The cubs (generally two or three, but sometimes four) are born in the winter den of the female; and are tiny things for such huge parents. Two born in the Zoological Park, New York, weighed eight

ounces each, and measured nine inches from nose to tail. The dam and cubs leave their den from one to three weeks after the male has left his winter quarters. A curious and unexplained habit of some Grizzlies at this time is that of scoring trees with their teeth; sometimes they will bite out considerable pieces from the trunks.

Of the nature and disposition of the Grizzly Bear something has been said above. In esti-

Photograph by C. J. Hawkins

BLACK BEAR CUB

Out on a foraging expedition

mating the conflicting accounts that have been printed, it is obvious that the experience and opinions of those who have hunted the animal and studied it at close range are most to be relied upon. Dr. Rainsford considers that the increase in the power of the rifle, and "the pressure of civilization felt more and more in the wildest parts of the land" have brought about a change in the habits of the Grizzly, and that "the danger of his attack, in the present day, has been grossly exaggerated." He accounts for many of the stories of "charging" Grizzlies by the fact that "when fired at, whether wounded or not, he will almost invariably turn downhill and try to get away, and in doing so, often nearly tumbles over his antagonist, who fancies the Bear is charging at him, when his sole intention is to get away as soon as possible." Mr. Wright has "never known of a single instance where one of these Bears turned out of his way, unprovoked, to attack a human being."

In captivity, the Grizzly Bear responds to fair treatment better than any other well-armed animal does; it generally reaches full maturity between the ages of six and seven years. In 1909, in the Cenetral Park Menagerie, New York, a Grizzly was chloroformed which was more than twenty-five years old. That the Grizzly can be tamed, if taken young, has been abundantly proved. James Capen Adams ("Grizzly Adams") had two which he had reared from cubhood, "Lady Washington" and "Ben Franklin," the former of which used to carry his blankets, etc., and sleep near him, and the other saved his master's life when attacked by a wild Grizzly.

Early settlers have testified that this Bear often caches its food. On a ranch near the upper waters of the Colorado River, several years ago, some colts were seized by Grizzly Bears. One of them was found buried according to the custom of this Bear, and the owner sat up to shoot the animal. Having only the old-fashioned small-bored rifle of the day, excellent for shooting Deer, but useless against so massive a beast as this Bear, unless hit in the head or heart, he only wounded it. The Bear rushed in, struck him a blow of its paw, smashed the rifle which he held up as a protection, and struck the barrel on to his head. The man fell insensible, when the Bear, having satisfied himself that he was dead, picked him up, carried him off, and buried him in another hole which it scratched near the dead colt. It then dug up the colt and ate part of it, and went off. Some time later the man came to his senses, and awoke to find himself "dead and buried." As the earth was only roughly thrown over him, he scrambled out, and saw close by the half-eaten remains of the colt. Thinking that it might be about the bear's dinner time, and remembering that he was probably in the larder for the next meal, he decided that he had an urgent engagement elsewhere.

BROWN BEAR

While a beast of enormous size, Bears are by no means so ferocious as often painted. This is a Siberian cousin which prefers the solitary wastes where it may hunt undisturbed

ALASKA BROWN BEAR

Ursus middendorffi *Merriam*

Other Names.— Kodiak, or Kadiak Bear.

General Description.— General appearance about as in Grizzly Bear. See general description of Grizzly Bear. Largest of American carnivores and probably largest in the world. General color golden-brown. Shoulders high, head broad, forehead massive, nose flat, short, square; drop in the line of the head directly in front of eyes.

Dental Formula.— Same as that of Grizzly Bear.

Pelage.— Sexes similar and seasonal variation rather slight. Color uniform brown or golden with same color on the legs. Coat long, thick and shaggy.

Measurements.— Length, 9 to 10 feet; height at shoulders, 45 to 50 inches. Weight, 1200 to 1600 pounds.

Range.— Kodiak Island and adjacent mainland of Alaska.

Food.— Principally salmon and vegetation.

Remarks.— The Kodiak Bear is regarded as a representative of the group of Big Brown Bears ranging throughout northwestern Arctic America. This group is differentiated from the Grizzly Bears farther south, to whom they are very closely related, mainly by the lighter brown coloration of the pelage, higher shoulders, wider head and shorter claws. The Kodiak Bear is probably the largest of the group but they are all large animals. Some six or eight species of this group have been described.

Related Species

Kodiak Bear.—*Ursus middendorffi* Merriam. Typical animal as described above. Kodiak Island and adjacent mainland of Alaska.

Yakutat Bear.—*Ursus dalli dalli* Merriam. Size large; skull flattened in frontal region as contrasted with highly arched frontals of *middendorffi*. Yakutat Bay region, Alaska.

Peninsular Brown Bear.—*Ursus dalli gyas* Merriam. Larger than *dalli*, about same size as Kodiak Bear. Region about Pavlof Bay, Alaska.

Merriam's Brown Bear.—*Ursus merriami* Allen. Allied to Yakutat Bear but differing in cranial characters. Region about Portage Bay, Alaska.

Kidder's Brown Bear.— *Ursus kidderi* Merriam. Decidedly smaller than Kodiak Bear, color much like that of Peninsular Bear. Cook Inlet region, Alaska.

Sitka Brown Bear.—*Ursus sitkensis* Merriam. Smaller than *dalli* and teeth of distinct type. Region about Sitka, Alaska.

The Alaska Brown Bear enjoys the distinction of being the largest flesh-eating animal in America, and probably in the world. Its huge bulk, powerful limbs, and beautiful coat of golden-brown unite to give it an imposing appearance. It stands very high at the shoulders, compared with its length, while its broad head, heavy forehead, and small gleaming eyes have given it a reputation for ferocity which many accounts belie.

The habitat of this interesting Bear extends along the coast of southeastern Alaska and most of the large islands adjacent thereto. Kodiak Island and the Alaskan Peninsula seem especially adapted to their liking. Here they roam over this immense rugged country, seldom molested by man and certainly not by any other enemy.

Alaskan Bears hibernate during the long Alaskan winters, and their hibernating dens are generally in the most rugged mountains, where, even in summer, there is no vegetation. The cubs, usually two in number, are little round balls of fur, so small that a man could easily hold one in the hollow of his hand. In Alaska, it is daylight from June to September; and when the bears come down to the lowlands they usually settle themselves in a brushy, well-watered valley. Here the cubs will play for hours at a time in the long sunshine, the mother Bear watching them or dozing in the dry grass. In their first lessons in living off the country, the cubs begin with ptarmigan chicks and field mice. Later the mother Bear instructs them in catching marmots and ground squirrels. As the summer passes, the hungry beasts make their way to the salmon rivers as the fish are coming up from the sea to spawn. They generally fish in shallows above a deep pool. Stationing themselves where there is hardly sufficient water to cover the pebbles, they will patiently wait for the fish to come within their reach, when they will throw the salmon out upon the bank with their paws and feast to their heart's content. When the salmon have gone, the Bears betake themselves to the heights above the timber line, where they may be seen "like grazing oxen rolling across the hills." They are now taking on fat for their long winter's sleep, and their fur grows long and silky.

The New York Zoological Park possesses one of the largest Alaskan Bears in captivity — known as Ivan. He was taken at the head of a canyon looking down on Bering Sea. The mother had been killed, and the cub, which was standing by the body, was driven into a glacial stream. His captor says: "He was helpless in the swift water, and I caught him behind his

furry ears, and as I carried him dripping and kicking to the bank, the mountains re-echoed to his grievances. We used our heavy woolen socks to muzzle his mouth and paws, and then, rolling him up in a pack strap, I swung him onto my back. . . . We fed the cub on raw seagulls' eggs, and he thrived on the diet."

Alaska Bears prefer to stay near the coast, as their natural food is found in the vicinity of salt water. Their chief diet consists of salmon, of which they consume large quantities, as the fish swarm up the small rivers and shallow streams.

The run of the various kinds of salmon lasts from June to October. During this period the Bears fatten up and upon this fat they live through their long winter sleep. They den up for the winter some time in November, depending upon the latitude and the severity of the weather.

Most Bears remain in their den until April before emerging, but occasionally, for one reason or another, they will roam abroad even in midwinter. Possibly their quarters become uncomfortable and they are compelled to look up another den.

Usually they select their dens well up on the rough and broken mountain sides, where the rocks form a natural cave, and it is probable that the same winter quarters are used year after year. The male Bear is the first to come out in the spring. On emerging he partakes very sparingly of food and only nips the tender tops of green grasses, and in fresh water localities of skunk cabbage, until he becomes used to eating and digesting food again.

He now turns his attention to the salmon berry and roots. By this time he is feeling quite himself again, and now begins to wander far and wide for the track of a female. After finding a mate he follows her persistently and it is at this time the mating season begins. This period lasts generally from the first of May till July.

The cubs are born in the winter den of their mother, usually about the first of the year, or in February. They are very tiny, compared to the size of their mother, and would weigh sometimes near a pound and a half. There are from one to four in a litter, two I think, more often occurring. Their eyes are not open and they are quite helpless for the first few weeks.

The cubs follow their mother, and den with her the first fall, and it is not until the second fall that they shift for themselves. They grow to enormous size, just how large no one can accurately state. There is one mounted in the American Museum of Natural History that weighed, when alive, 1600 pounds. It stood four feet four inches at the shoulders and measured eight feet in length. Dr. Hornaday once showed me an unstretched skin that measured nine feet, four inches.

When one considers that a big lion will not weigh more than 500 pounds, one will gain some idea of the huge bulk of this beast. The length of an animal's skin can only be fairly measured, and properly, by doing the measuring before it is removed from the animal. A skin stretched and measured means very little, as it is possible to stretch a skin into almost any shape or size.

The head of the Alaska Bear is very massive, and he stands high at the shoulder. This characteristic is emphasized by a thick tuft of hair which stands erect on the dorsal ridge above the shoulder.

The Bear's senses of smell and hearing are developed to an extreme degree. Its vision however, as in most of the Bear family, is not particularly good. The difficulty seems to be in discerning or separating objects that are inert; for instance, if a man remains perfectly still, he is not likely to be detected, unless scented or some movement is made.

The color of the pelage ranges from a creamy tan to a dark brown, and in some cases almost black.

In several sections the Alaskan Bears have been divided into subspecies under the following names: Those found on Kodiak Island are classed under the name of *Ursus middendorffi*. They have long noses and belong to the long-skulled group with the large and slightly curved claws. This species was first described by a man who bore the name of Middendorf, and in whose honor it was named. This same species is found also on the mainland, and I had the good fortune to shoot one at the head of Snug Harbor, which is on the west coast of Cook Inlet. Chinitna Bay is thirty miles south of Snug Harbor, and in both of these sections the *Ursus middendorffi* and another subspecies are found. The second is classified under the name of *Ursus kidderi,* and is generally of a lighter color on the body and darker on the legs, while the nose and skull are shorter than the Kodiak variety. The Bears from the Copper River districts are the short and thick-muzzled species, and take the name of *Ursus dalli.* The Admiralty Bear, *Ursus eulophus,* represents a

large species found on Admiralty Island. Its color usually resembles that of the Kodiak Bear.

The Bears found well down on the Alaskan Peninsula, *Ursus gyas*, have a tendency to more of a brownish yellow color. Their claws are of great size and thickness. This species inhabits the open country — that is, for the most part devoid of timber. There are undoubtedly other sections where the Bears differ from the ones already described.

It is commonly believed that feigning death will prevent a Bear from inflicting further injuries, and I have heard of several cases where it is supposed to have saved men's lives. The supposition is that the Bear, believing his victim dead, goes on about his business. With beasts of prey this strategy must not be too much relied upon. In some cases it may prove effectual with Bears, as Bears do not as a rule eat human flesh. But with the Cat family I think it would prove ineffective. Probably the conventional expression, "the Bear hug" has no significance. Black Bears hug tree trunks in ascending trees adapted to their embrace, but the Brown Bear is too large and too heavy for that, and the claws are not adapted for climbing. In fact, like the greater *Felidæ*, they are not constructed for any arboreal gymnastics. There is no available evidence to show that this or any other Bear attempts to inflict injury by hugging an enemy with its arms.

There is great divergence of opinion as to the disposition of the Alaskan species, some saying that it will avoid man, others that it will not hesitate to go out of its way to make an attack. Mr. Edward G. W. Ferguson, who spent seven years in Alaska and familiarized himself with the country and its fauna, is convinced "that he is just naturally fearless and savage most of the time." He cites two cases where this Bear deliberately chose to attack men. In one of these a Swedish prospector was making his way to where he had left his pack. "His path was of necessity circuitous, and he was scrambling his way among the huge boulders, when suddenly he came face to face with a 'Silvertip' (the local name of the Kodiak). The Bear growled, dashed for him, mouth wide open, eyes ablaze. The Swede, panic-stricken, thrust his gun forward, and providentially into the Bear's open mouth, and well into his throat. The Bear closed his jaws over both barrels and crushed them; but before he did this the Swede, unintentionally without doubt, pulled both triggers and the charge shattered the Bear's spine. The carcass was brought to town . . . and measured six feet seven inches from nose to tip of the tail."

The other case was that of a rodman engaged in surveying, who was startled by seeing one of these Bears waddle out of the brush and make its way toward him. "The rodman backed away toward the water as fast as he could, but did not fire, realizing that his weapon, a shotgun, could only wound and anger, but could not possibly kill the beast. I grabbed my rifle and ran up the bar. The Bear did not even turn its head to look in my direction, and by the time I was within 100 feet of him the rodman had backed into the stream up to his waist, and the Bear was wading in after him. I yelled to him and he let go both barrels at once full into the brute's face. As we found out, the shot had blinded him in both eyes. While he was roaring and thrashing about, beating the water to a froth, I carefully emptied the magazine into him, coming closer at each shot."

This writer claims that the Bear "had no reason for deliberately coming out of the woods and chasing the rodman into the water" and that he can be relied upon to tackle a man whenever he comes across one.

Mr. Charles Sheldon, who hunted this Brown Bear on Montague Island in 1905, made this entry in the diary of his trip: "I had proceeded but a few steps when suddenly I saw about eight feet away, on the curving border of the spruces, running directly at me, what appeared to be a huge Bear. I had just time to push forward the butt of my rifle, and yell, when it collided with me, knocking me down. It seemed to turn slightly to the left as I pushed my rifle into it, and I clearly recall its shoulder striking my left hip, its head striking first above my left knee, while its claws struck my shin, so that it is now black and blue. I had the sensation of being mauled and mutilated. As I fell, to the right, my rifle dropped, and in my confusion, I grabbed with my left hand the animal's fur. . . . The Bear was, I believe, more surprised than I. I felt its fur slip through my hand, as it quickly turned to its right, and, swinging about, ran back over the hill without any attempt to bite or strike me."

DANIEL J. SINGER.

BARREN-GROUND BEAR

Ursus richardsoni *Swainson*

General Description.— See also general description of Grizzly Bear. Size large, muzzle short and slightly upturned, dentition of Grizzly Bear. Color yellowish-brown to very much lighter.

Dental Formula.— See that given for Grizzly Bear.

Pelage.— General color throughout yellowish-brown varying in individuals to yellowish so that animal has whitish appearance.

Measurements.— Length, 8 feet; tail, 3 inches; height at shoulder, 3 feet, 6 inches.

Range.— Barren Grounds between Hudson Bay and MacKenzie River; hilly regions east and north of Great Bear Lake; also Rockies west of MacKenzie possibly to the upper tributaries of the Yukon.

Food.— Small rodents, ground squirrels, mice, etc., and berries and grass.

Remarks.—This bear, while generally placed by authorities in the group of the Grizzly Bears, has, nevertheless, characters not found among the Grizzlies. Its range is in a region of heavy snowfall, a treeless region, and because of these facts it has developed habits differing from those of its northern relatives. It ranges throughout its northern habitat without becoming differentiated into more than the one species.

Little is known concerning the Barren-Ground Bear, because of the inaccessibility of its home. We know its general appearance, measurements, and color, but beyond that have not cultivated its acquaintance very extensively. It lives, as its name indicates, in a treeless waste of country in the far North, between Hudson Bay and the Mackenzie River; also to the east and north of Great Bear Lake. It is about the size of the Grizzly Bear, which it generally resembles; but it has a shorter muzzle and a yellower coat. Its fur, especially in winter, is remarkably thick.

The hibernating period is very long, often six months of the year, because of the relatively short summer; and when the animal emerges from its den, pinched by hunger, it is alert and frequently savage. The number of cubs born during the winter period is from two to four. They are extremely small at first, but rapidly develop as soon as they get out into the sunlight.

These Bears are both flesh-eaters and vegetarians. Any fish, flesh, or fruit in season is welcome. Their enemies are few, because of the desolate country they inhabit.

AMERICAN BLACK BEAR

Ursus americanus *Pallas*

General Description.—A medium-sized animal weighing 250 to 400 pounds and black in color. Form robust; legs short, powerful; claws long, sharp, somewhat curved; tail short; soles naked; plantigrade. Molar teeth are broad, flat crowned and lack high sharp cusps. Hair long and moderately soft. Ears erect, rounded.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{2-2}{3-3}$=42.

Pelage.— Notably of two phases in most regions, not infrequently the two phases being represented at a birth. These color variations are the black and the cinnamon. *Black Phase.* Adults and young similar; sexes identical. General color black, varying from brownish black to coal black, often with a white spot on breast; face tinged with cinnamon-brown or tan-brown. *Cinnamon Phase.* Everywhere cinnamon-brown, often with a lighter shade of brown on nose.

Measurements.— Sexes almost equal. Length, 6 feet, 5 inches; height at shoulder, 3 feet; tail, 5 inches; hind foot, 8 inches. Weight, 200 to 400 pounds.

Range.— Wooded North America except Louisiana and Florida, where other species occur,

Food.—Omnivorous; fruit, berries, grass; mice, squirrels, and any other mammal it can catch; birds and eggs; fish and frogs; ants and their larvae; honey and young bees.

Remarks.— The Black Bear group contains the smallest of the North American Bears, although the Black Bear is itself a good-sized beast. In the eastern part of the United States the cinnamon phase is very rare, but in the western part of its range it is about as common as the black phase. The Black Bear is much the same wherever he is found, but local abundance or scarcity of food sometimes produces greater or lesser size, and in addition some habits have produced sufficiently profound changes to warrant the establishment of different species. Of the 14 species and subspecies currently recognized, those below listed are the best known.

Related Species

American Black Bear.— *Ursus americanus americanus* Pallas. The typical stock. Greater part of wooded North America, with the exception of the southeastern United States and northeastern Canada.

Louisiana Black Bear.—*Ursus luteolus* (Griffith). Size large; molar teeth very large. Normally black but cinnamon phase is known. Louisiana to Texas.

Florida Black Bear.—*Ursus floridanus* Merriam. Very large; wholly black. Everglades of Florida.

Queen Charlotte Islands Black Bear.—*Ursus carlottae* Osgood. Large; skull longer; teeth larger and heavier. Glossy black. Queen Charlotte Islands, British Columbia.

See also Glacier Bear and Kermode's Bear.

BLACK BEAR

Although powerful animals, the Black Bears are notoriously timid, so far as man is concerned, and to stalk one unaided is a task to try any hunter's patience

This Bear has been described, by one who has studied it in the open for nearly thirty years, as "the most amusing, the most ludicrous, the most human and understandable of our wild animals." In its native state, it exists in larger numbers and is more widely distributed than any other species of bear; and in captivity, it is one of the most "popular" of quadrupeds. It is the performing Bear *par excellence*, the Bear that can climb a tree; and its cleverness in learning tricks, its general tractability, and its playful disposition have combined to make it an invariable as well as an invaluable feature of most menageries.

Paradoxical as it may seem to say so, not all Black Bears are black. The ten or twelve members of the group show remarkable varieties of coloration, including glossy black, yellow-brown, olive-yellow, and mouse color; in the region of Flat Head Lake, in Montana, a number of albinos were seen. This variation in color has often given rise to the mistaken idea that the black and the brown individuals of the group are different species. They are not.

Black Bears mate just before going into winter quarters. They are not particular about their winter home. The hibernating den may be

any place that offers a fair promise of privacy and protection. A favorite device of the Black Bear is "to dig a hole under the butt end of a fallen tree, rake a few leaves into the opening, and then crawl in himself." Mr. William H. Wright, the well-known writer on bears, had a tame Bear which made a winter home for himself under the carriage-house, foraging for rags with which he covered the floor several inches thick, and "once he came back dragging a fine cashmere shawl that he had pulled off a clothes line where a neighbor had hung it to air."

The beginning of the hibernation period varies with the weather and the locality. In the northwest it is from November to January; but the Black Bear will often come out for a time, if a warm spell occurs. It is a mistake to suppose that hibernating Bears are in a kind of comatose state, like the Woodchuck. They sleep, it is true; but they are easily aroused, and more than one hunter who has fallen through a crust of snow and landed on top of a hibernating Bear has found the animal to be very much awake. In captivity, hibernating Bears neither eat nor drink.

"All Black Bears hibernate during the winter months," says Daniel J. Singer. "There are, however, woodsmen in the South who disagree with me on this point, saying that they have seen their tracks during every month of the winter, and the mild climate does not force them to lie up in a cave or den as it would in the more severe weather of northern latitudes. I have myself seen bear tracks during the winter months, and even in the deep snow of the northern States. But this is the exception, and I have no doubt that these Bears are simply shifting to another sleeping place, having been driven out for one reason or another. Their dens may not have been well chosen, and they possibly became leaky, or exposed to the winds, or some hunter might pass that way with a keen-nosed, inquisitive canine that would cause him to roll out in a hurry. It is safe to say, all Black Bears den up, both North and South, some time between November 1st and January 1st, depending upon the altitude, weather and latitude. They emerge in the spring, usually from the first of April to the middle of May, according to conditions, the males often appearing some two weeks before the females. It is at this time in the spring, just after they have left their winter quarters, that a Bear's pelt is in its prime. During hibernation, as no food is laid up, they, of course, do not eat, nor do they drink, unless they make use of the snow that has fallen about them. Contrary to the general supposition, they are not in a deep coma or hazy condition, for they are easily aroused. It is true that they sleep, but are quick to detect danger and fully equal to the occasion of making off and looking up other quarters if disturbed.

"Another much mistaken idea about the Black Bear is that he emerges from his winter quarters very thin and emaciated (this so far, is true); that he is desperately hungry after his long fast;

Photograph by J. H. Murphy

BLACK BEAR CUB

Taking an observation on a fallen tree

or is terribly ferocious, and inclined to attack anything on sight, man included. This is not so, although I have often heard it so stated. Not even a Black Bear with his enviable digestive apparatus can or does indulge in a hearty meal after so long a fast. The organs of a Bear are no different from those of a man in this respect, and after their long disuse are only capable of assimilating the daintiest morsels of food — such as grass shoots, tender roots and the like. In fact, at first he shows little or no desire to eat."

Black Bear cubs, numbering one to four — litters of the latter size are by no means un-

common — are born in the winter den of the mother between January and March, and from six weeks to two months before the mother comes out. They are almost naked, toothless, and their eyes do not open for some time. Single cubs vary in weight from eight to eighteen ounces. Usually, though not always, the Black Bear mother leaves her cubs to shift for themselves at the close of their first summer.

In the matter of food the Black Bear is easy to please. Centipedes, bumblebees, and hornets; wild white clover and skunk-cabbage roots; frogs, toads, and field mice — all are acceptable to him. He is, too, inordinately fond of ants. He will run one of his forelegs deep down into an anthill, give his paw a twist, and await results. "Out rush the ants, mad as hornets and looking for trouble. They get it almost immediately. They discover the Bear's furry paws and begin to swarm over them. And as fast as they appear the Bear licks them up."

One characteristic of the Black Bear in feeding is that it does not cache its food. The Grizzly will store fish and hide a carcass; the Black Bear never does. The latter will learn to steal sheep, and is said to be a born pig thief.

As mentioned above, the Black Bear is preeminently a tree-climbing bear. Mr. Wright says: "He can climb as soon as he can walk, and his mother takes clever advantage of the fact. She sends her cubs up a tree whenever she wants them off her hands for a time — uses trees, indeed, very much as human mothers, who have no one to watch their children while they work, use day nurseries. The first thing a Black Bear mother does when any danger threatens is to send her cubs up a tree. . . In all my experience I have never known cubs, when thus ordered into retirement by their mother, to come down from the selected tree until she called them. . . . Later in life the Black Bear comes to regard trees as its natural refuge from all dangers. . . They can climb, and that with almost equal ease, any tree that will hold their weight; from a sapling, so small that there is just room for them to sink one set of hind claws above the other in a straight line, to an old giant so big that they can only cling to its face."

In the wild state, Black Bears will play together, and they "have a funny trick of pretending not to see each other when they meet." They are not given to systematic labor in seeking their food; will "work hard at any kind of mischief, but seem to hate to work steadily for business purposes." Probably no animal is so quick to evade the hunter. A recent writer asserts that on a highway in New Hampshire a Black Bear kept ahead of his automobile for a short distance when going at the rate of nearly thirty miles an hour.

The fur of the Black Bear is a valuable article of commerce. In the early part of the nineteenth century, in a single year 25,000 skins were imported into England, where they were used chiefly for military accoutrements.

There are so many tame Black Bears, and their tricks and antics are so familiar that it is scarcely necessary to refer to them here. It may, however, be of interest to cite an occasion when a well-known stunt was given with an unexpected variation. Mr. W. H. Wright, when in Missoula, Montana, had nailed up the door of the shed in which his tame Black Bear, Ben, was confined. Some boys broke it open, with serious results for one of them. The Bear's owner writes: "In front of my house a mob was gathering. . . . At first I could make neither head nor tail of the clamor, but finally gathered that that bloodthirsty, savage, and unspeakable Bear of mine had killed a boy; and upon asking to see the victim was told that the remains had been taken to a neighbor's house and a doctor summoned. . . . I found the corpse sitting up on the kitchen floor holding a sort of impromptu reception. . . . I could not help admiring the youngster's pluck, for he was an awful sight. From his feet to his knees his legs were lacerated and his clothing torn into shreds; and the top of his head — redder by far than ever nature had intended — was a bloody horror.

"It developed that the two Urlin boys had broken open the door of the shed and gone in to wrestle with the Bear. Ben was willing, as he always was, and a lively match was soon on; another of the boys joined in the scuffle. Then one of them got on the Bear's back. This was a new one on Ben, but he took kindly to the idea and was soon galloping around the room with his rider. Then another boy climbed on and Ben carried the two of them at the same mad pace. Then the third boy got aboard and round they all went, much to the delight of themselves and their cheering audience in the doorway. But . . . after a few circles of the room Ben suddenly stopped and rolled over on his back. And now an amazing thing happened. Of the three boys, one happened to fall upon the upturned paws of the Bear; and Ben, who for years had juggled rope balls, instantly undertook to give an exhibition with his new imple-

From a painting by Belmore Browne

ALASKA BROWN BEAR

This huge Bear enjoys the distinction of being the largest carnivore in America, and probably in the world.

ment. Gathering the badly frightened boy into position, the Bear set him whirling. His clothing from his shoe tops to his knees was soon ripped to shreds and his legs torn and bleeding; his scalp was lacerated by the sharp claws until the blood flowed; his cries arose to shrieks; but the Bear, unmoved, kept up the perfect rhythm of his strokes. Finally the terrified onlookers realizing that something must be done, tore a rail from the fence and with a few pokes in Ben's side induced him to drop the boy. . . . So square and true had Ben juggled him that not a scratch was found on his face or any part of his body between the top of his head and his knees. He eventually came out of the hospital no worse for his ordeal, but I doubt if he ever again undertook to ride a Bear."

By permission of the New York Zoological Society

BLACK BEAR

The Black Bear was the species first encountered by the early settlers on the Atlantic side of America. The Grizzly belongs to the Rocky Mountain region

The early backwoodsmen found the Black Bear a troublesome neighbor. It liked Indian corn, and was not averse to a young pig. "Like the Deer," says Audubon, "it changes its haunts with the seasons, and for the same reason, viz., the desire of obtaining food. During the spring months it searches for food in the low alluvial lands that border the rivers, or the margins of the inland lakes. There it procures abundance of succulent roots, and of the tender, juicy stems of plants, upon which it chiefly feeds at that season. During the summer heat it enters the gloomy swamps, and passes much of its time in wallowing in the mud like a hog; it seizes a young pig, or perhaps a sow or calf. As soon as the different kinds of berries ripen, the Bear betakes itself to the high ground; next visits the maize fields, which it ravages for a while. After this the various kinds of nuts and grapes, acorns and other forest fruits, attract its attention. The Black Bear is then seen wandering through the woods to gather this harvest, not forgetting to rob every tree which it comes across."

According to Dr. Merriam, the food of the Black Bear "consists not only of mice and other small mammals, turtles, frogs, and fish, but

also, largely of ants and their eggs, bees and their honey, cherries, blackberries, raspberries, blueberries and various other fruits, vegetables, and roots. He sometimes makes devastating raids upon the barn yards, slaying and devouring sheep, calves, pigs and poultry." Another writer, Mr. C. C. Ward, states, as the result of his own experience, that the Black Bear, "is growing more carnivorous and discontented with a diet of herbs. Assuredly, he is growing bolder. He is also developing a propensity to destroy more than he can eat, and it is not improbable that his posterity may cease to be frugi-carnivorous. It is fortunate that an animal of the strength and ferocity which he displays when aroused seldom attacks man. The formation of his powerful jaws and terrible canine teeth are well adapted to seize and hold his prey, and his molars are strong enough to crush the bones of an ox. His great strength, however, lies in his fore-arms and paws. His mode of attacking his prey is not to seize it with its teeth, but to strike terrific blows with his fore-paws. His weakness is for pork, and to obtain it he will run any risk. When the farmers, after suffering severe losses at his hands, become unusually alert, he retires to the depths of the forest and solaces himself with a young Moose, Caribou, or Deer. He seldom or never attacks a full grown Moose, but traces of desperate encounters, in which the Cow-Moose has battled for her offspring, are frequently met with in the woods."

CINNAMON BEAR

This is not a distinct species, but only the local name for Black Bear in one of its curious color phases. The Black Bear, indeed, runs through many varying shades, and often brown and black cubs are found in the same litter. In Alaska and the Rocky Mountains it is frequently found with a brown or cinnamon coat — hence its name. See description of Black Bear.

Photograph by J. M. Johnson

BLACK AND CINNAMON BEARS

Feeding together in Yellowstone Park. They are quite tame in this reservation

GLACIER BEAR

Ursus emmonsi *(Dall)*

General Description.— See also American Black Bear. In general like the Black Bear but smaller and body color a bluish-black with white-tipped hairs.

Dental Formula.— Same as for Black Bear.

Pelage.— Sexes similar. A remarkably soft pelage, the hairs not very long; rich underfur of a bluish-black, with many of the long hairs white or tipped with white; dorsal line from tip of nose to rump, the back of the short ears and outer surfaces of limbs, jet black; sides of the muzzle and lower anterior cheek are a bright tan; no brown elsewhere in pelage.

Measurements.— Smallest of American Bears. Height at shoulder, 2 feet.

Range.— St. Elias range of mountains southeasterly to Juneau.

Food.— Similar to that of the Black Bear.

Related Species

While there are no related species of similar color pattern, one with much the same status, and also considered by some as still another color phase of the Black Bear, is Kermode's Bear.

Kermode's Bear.—*Ursus kermodei* Hornaday. General form like Glacier Bear and like it in size. Color, white, more or less pure in tone. Range in British Columbia just south of Alaska.

The Glacier Bear is a remarkable and little known animal that frequents the edges of glaciers in Alaska, chiefly near Mt. St. Elias. Some fur dealers call it the Blue Bear, from the indefinite bluish-gray tinge of its fur. The Glacier Bear is timid and retiring. It has been seen by but few hunters, and has not yet been captured alive for any zoological park, because of the wild bleak country which it frequents.

Although quite distinct in size and appearance from the American Black Bear many authorities today regard the Glacier Bear as but a color phase of the normal black variety. However, if this be the case it is a unique phase and has no duplication among the Black Bears in other regions of North America. According to this view, the Glacier Bear would be analogous to the Silver Fox, an unusual color phase of the common Red Fox.

The Glacier Bear has one of the softest and most beautiful coats of any of the Bears, and for this reason is much sought after. The fur has something of the smooth, fine texture of the seal, and in the same way is remarkably adapted to the double purpose of keeping the animal warm and dry. It is distinctively marked so that it cannot be mistaken. This is the smallest of all the American Bears, being only two feet high.

BLACK BEAR HUNTING BEES

The Black Bear is a great bee hunter, and is inordinately fond of honey

Photograph by H. T. Middleton

"LOOK PLEASANT, PLEASE"

This Raccoon is awaiting, somewhat anxiously, the result of the clicking instrument in the amateur photographer's hands

THE RACCOON FAMILY

(*Procyonidæ*)

THE Raccoon family in North America is limited to two members — the Raccoon, of which there are several species, and the Ring-tailed Cat. These animals are Carnivores, with head broad at the back and tapering rapidly forward to a narrow muzzle. Ears are of moderate size. Feet are plantigrade, with soles naked. The toes are free, and capable of being widely spread. The claws are curved, and non-retractile. The tail is semi-bushy, and generally ringed. The body is short and stocky.

One member of this family is among the best known of our native animals; while the other is almost entirely unknown even to many sportsmen. This is because of the latter's restricted range in the desert lands along the Mexican border.

EASTERN RACCOON

Procyon lotor (*Linnaeus*)

General Description.—A short-legged, long-haired animal the size of a small dog (Cocker Spaniel). Head broad; nose pointed; tail bushy, cylindrical, and annulated; ears erect and comparatively short; toes five on all feet; soles of feet naked; plantigrade; general color grayish or yellowish-gray, black patch about eye, and blackish rings around tail.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars $\frac{4-4}{4-4}$; Molars, $\frac{2-2}{2-2}$=40.

Pelage.— Sexes alike; young similar to adults but rather grayer at first. Above, grayish or dull brownish-gray becoming yellower on back, strongly yellow on nape and on tail, and a paler gray on belly and feet; long hairs of entire upper parts, especially of dorsal region, black-tipped, of lower parts, white-tipped; on cheek a black patch that includes eye and joins with the narrow blackish stripe that runs from nose to the dark color on forehead; face dull white, whitest in band above each eye; ear behind black, joining with a black patch on neck back of ear; tip of ear whitish behind; tail with 6 or 7 rings of very dark brown or black on a pale yellowish background; eyes dark, whiskers white.

Measurements.— Considerable variation. Average length, 32 inches; tail, 10½ inches; hind foot, 4½ inches. Weight 15 to 22 pounds.

Range.— Eastern America from Canada to Georgia, west to the Rocky Mountains north of Texas.

Food.— Quite omnivorous; frogs, fish, small mammals, birds and eggs, reptiles, insects, shell-fish, fruits, corn and grain.

Remarks.— The Raccoon has often been called the little brother of the Bear, this association being due mainly to the resemblance in build and in the naked, full-soled feet. The Raccoon is the sole representative (with the exception of the Ring-tailed Cat) of a family found only in the New World; there are no Raccoons in the Old World. Differences in size, color and proportions of the skull account for the separation of the North American Raccoons into six species and subspecies.

EASTERN RACCOON

The Raccoon's habit of washing its food before eating it, even in captivity, is one of its peculiar traits

Related Species

Eastern Raccoon.— *Procyon lotor lotor* (Linnaeus). The typical animal described above. Eastern America from Canada to Georgia, west to Rocky Mountains north of Texas.

Florida Raccoon.— *Procyon lotor elucus* Bangs. Darker, shorter haired, longer tail. Eastern Georgia and Florida.

Hernandez Raccoon.—*Procyon lotor hernandezii* (Wagler). Size large; colors dark; tail tapering; black rings on tail, narrow. Along southern Pacific Coast north into California.

California Raccoon.—*Procyon psora psora* Gray. Found along the central Pacific Coast.

Desert Raccoon.—*Procyon pallidus* Merriam. See description following.

The Raccoon is found only in North and Central America, from Alaska in the north to Costa Rica in the south. It is common to the whole of the United States. Raccoons are gen-

Photograph by Julian A. Dimock

UP A TREE

Brer 'Coon has an anxious look, as though he had sighted his arch enemy, the dog

erally found in the woodlands near civilization, but avoid the dense evergreen forests of the interior. Like the numerous bats and the flying squirrels, they are one of the most nocturnal of North American mammals, yet they may occasionally be seen abroad on cloudy days. In diet they are preferably flesh-eaters, feeding upon poultry, mice, young birds, bird's eggs, fresh-water tortoises and their eggs, frogs, fish, molluscs and insects. Occasionally, however, they vary this with a diet of nuts, fruits and corn. They delight to sport in the shallow water on the margins of pools and streams, where they capture the smaller fish lurking beneath the stones, and the fresh-water mussels buried in the mud and sand. They also catch such fish as happen into pools near the shore, although they are unable to dive in pursuit of their prey. They are, however, good swimmers. Although first-rate climbers, and making their nests in a hollow high up in some large tree, Raccoons cannot be considered arboreal animals. They neither hunt their prey among the tree-tops, nor feed upon the young shoots and twigs. Trees, however, form their nesting and breeding places, and likewise their refuge when pursued by human or other foes. With the falling shades of night they invariably descend to hunt their prey and search for food.

This animal is known colloquially all over the United States as the "Coon." Its fur was highly prized by the early settlers, and Coon-skin caps were a staple article of apparel. In weight it is about equal to a common Fox, but it is short and stout. Restless, inquisitive, and prying, it is a most mischievous beast where farmyards and poultry are within reach. It kills the fowls, eats the eggs, samples the fruit, and if caught, generally puts up a stiff fight, although it sometimes shams death with all the skill of an Opossum. It is very fond of fish and shell-fish, and opens bivalves with wonderful skill. With one crunch it will break the hinge with its teeth; its paws complete the work of getting out the meat. It must have a delicate sense of touch, for in the task it rarely avails itself of sight or smell. It passes the mussel under its hind paws; then, without looking, it seeks with its forepaws the weakest place. It there digs in its claws, forces asunder the valves and tears out the flesh in fragments, leaving nothing behind.

The Raccoon has been one of the most valuable of the fur-bearing animals of North America, and is consequently much persecuted. Raccoon skins were formerly used as a recognized circulating medium in the States of the Mississippi valley.

The Raccoon may be easily caught in steel traps; but it is essential that these should be set under water near the margins of swamps or streams. The more sporting method in the South is to hunt these animals at night with specially trained dogs, which are usually a breed of Fox-hounds. It has often been stated that the Raccoon leaves a very faint foot-scent; but this opinion is controverted by some hunters who state that hounds will hunt a Raccoon at midday over snow, on a trail which has been made the previous night. The Raccoon after a short run invariably takes to a tree, and stays there until it is captured or escapes. It will stick tightly even while the tree is being felled to bring it to earth.

Like the Bear, the Raccoon is plantigrade in its manner of walking. It has been nick-named "the little brother of the Bear," from this and other similarities. For example, it is fond of dipping its food into water before eating it.

Concerning this trait, Mr. Witmer Stone says: "It is curious that the quaint custom of washing meat of all kinds before eating it should be clung to so religiously by the Raccoons of all parts of the country. Raccoons are so easily domesticated and prove such amusing pets, that accounts of tame Coons are to be picked up almost anywhere, and although exhibiting plenty of originality in most ways, they all seem to agree in this one particular, that when meat is offered them it must be thoroughly washed or else eaten under protest apparently, many a Coon preferring to go hungry rather than eat flesh which it has not been allowed to wash. Moreover, they are not willing to let any one else do the work for them, insisting rather on being allowed to do it all themselves, holding their food in both fore paws and sousing it about in the water until it is reduced to a pallid, flabby, unappetizing mess which only a Coon could look upon without misgiving."

Raccoons are most at home in a hollow tree. Here they construct a rough nest and rear five or six young every year. "The Raccoon hibernates during the severest part of the winter," says Dr. Merriam, "retiring to his nest rather early, and appearing again in February or March, according to the earliness or lateness of the season. Disliking to wade through deep snow he does not come out much till the alternate thawing and freezing of the surface, suggestive of coming spring, makes a hard crust upon which he can run with ease. He does not usually walk many miles during a single night, and consequently is soon tracked to the tree, in some hole of which he has retired for the day. It is unusual to find a Raccoon alone, for they commonly live and travel in small companies, consisting of several members of a single family."

Photograph by C. P. Cobb

SITTING TIGHT

The snows of winter do not bother the Raccoon as his fur coat is well lined

DESERT RACCOON

Procyon pallidus *Merriam*

General Description.— Much the same as Eastern Raccoon but colors pale, size medium.

Dental Formula.— See Eastern Raccoon.

Pelage.—Above, pale gray darkened by short black tips to the coarse hairs; below, grayish-white, the drab underfur being nearly obscured; tail long and slender, with narrow blackish rings; hind feet pale gray.

Measurements.— Length, 33 inches; tail vertebrae, 12 inches; hind foot, 5 inches; height of ear above crown, 2 inches.

Range.— Colorado Desert, California.

Food.— Fish, birds, small mammals, frogs and a few insects.

Remarks.— This is a pale desert adaptation of the genus. Because of the wide differences in the environments of the Desert and Eastern Raccoons it is not surprising to find some difference in their habits. The Desert Raccoon, however, is true to his descent to a considerable degree. For related species see under Eastern Raccoon.

Photograph by C. Reid

DESERT RACCOON

A near cousin of the Eastern species, but with paler markings

The Desert Raccoon is the western cousin of our more familiar friend. It is found from the treeless wastes of Colorado to the Sierra Nevada range, and varies both in color and habits to some extent from the common species. The heat of the sun and lack of shade have changed the hue of the fur from brown or black to dull gray. The animal is an inhabitant of bushy retreats and holes in rocks, and seeks its food along the ground. Where streams are encountered it is fond of fishing; it will indeed follow along water courses for long distances; and it will not disdain birds as a variant from its usual diet of rats, mice, frogs and insects. It does not hibernate like the eastern type, as the milder weather does not make such a course necessary. It is by nature a night prowler, its scent being so keen as to permit it to hunt its prey unerringly over the desert wastes, but it also roams occasionally by day.

RING-TAILED CAT

Bassariscus astutus (*Lichtenstein*)

Other Names.— Civet Cat, Bassarisk, Bassaris, Cacomistl, Mountain Cat, Raccoon Fox.

General Description.—Size a trifle smaller than domestic cat. A slender graceful animal with a long cylindrical tail marked by black rings alternating with white. Muzzle pointed; ears rather large; pads of feet naked, soles hairy, digitigrade. General color, above buffy, tinged with black; below white; tail white with 6 or 8 black rings. Fur fairly soft.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{2-2}{2-2} = 40$.

Pelage.— Adults: Sexes similar. Above yellowish-brown and gray mixed, with the long hairs black tipped; below white; legs and feet like body; tail above with alternate black and white bands and black tip; the black does not meet on under side of tail, so there is a continuous white line down the center of the under side. Young: Much as adults.

Measurements.— Length, male, 30 inches; tail, 15 inches; hind foot, 2½ inches; ear, 1½ inches. Weight 2½ pounds. Female a trifle smaller.

Range.— California, Texas, Arizona, New Mexico.

Food.— Small mammals, birds and eggs.

Remarks.— The American Ring-tailed Cat is easily distinguished from any other North American mammal by its long annulated tail and general appearance. Its closest relative, the Raccoon, is much larger and has a shorter tail. The name Civet Cat applied to this animal is really a misnomer, as the Civet Cats are found only in the Old World, but this name has been used locally in the West in place of the more proper one of Ring-tailed Cat.

Related Species

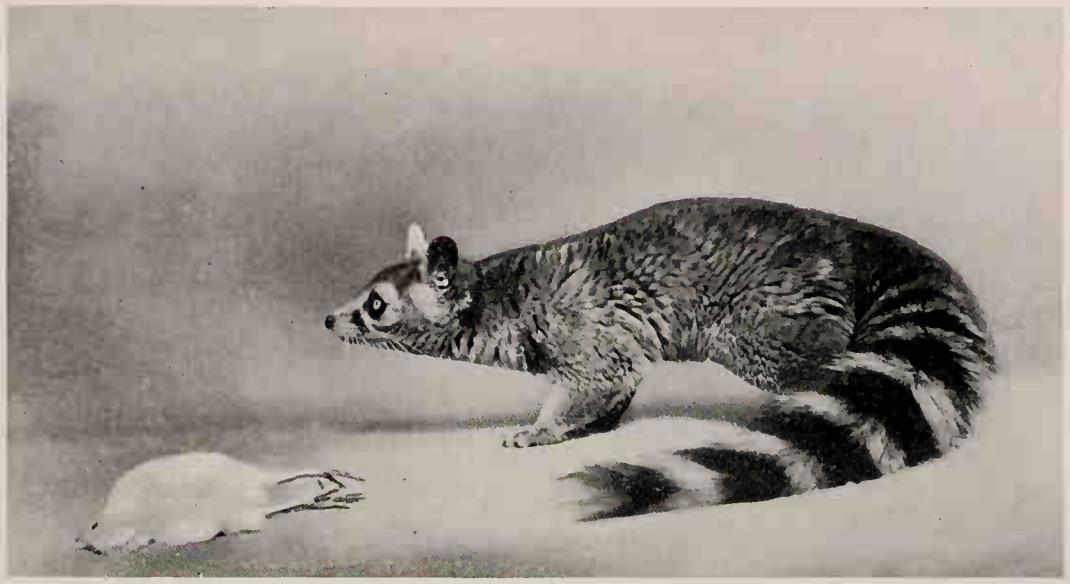
American Ring-tailed Cat.— *Bassariscus astutus astutus* (Lichtenstein). The typical form as described above. California, Arizona, Texas, New Mexico.

California Ring-tailed Cat.— *Bassariscus astutus raptor* (Baird). Darker with less gray, buffy white below. Rings on tail broader. California and Oregon.

Texas Ring-tailed Cat.—*Bassariscus astutus flavus* Rhoads. Smaller; tail often completely encircled by black rings; blackish tawny above. Texas.

Oregon Ring-tailed Cat.— *Bassariscus astutus oregonus* Rhoads. Dorsal region intense black; below strongly brownish-yellow. Oregon.

The American Civet Cat has the misfortune to be wrongly named. It is not a Cat, being more like a weasel; nor does it have any odor of civet about it. Dr. Coues speaks of it as the Bassarisk; and the reader may find other references to it as the "Bassaris," "Cat Squirrel" (so called in Texas); "Mountain Cat," and "Ring-tailed Cat" (California), and "Cacomistl" (Mexico). Dr. D. G. Elliot terms it the "Raccoon Fox," and this seems a very good name for it; for, as Dr. Hornaday pertinently remarks: "The Bassarisk is, after the true Raccoon, the only animal in the United States possessed of a long, bushy tail with alternating black and white rings around it . . . and it has a many-sided appetite like a Raccoon."



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RING-TAILED CAT

A little known wanderer along our Southwestern border, which has been blessed with many names

The Ring-tailed Cat, is found in Mexico north to California. In Texas, the tawny variety is common throughout the State except in the open plains of the western half. Although mainly a dweller in cliffs and rocks, it is found also in the chaparral, mesquite, and cactus plains of the southern part of the State right down to the coast, where it secures ample protection and small game in greater abundance than in its higher rocky haunts. According to Vernon Bailey ("Biological Survey of Texas"), at night "they prowl along the ledges of cliffs from cave to cave, leaving the prints of their little, round, catlike feet in the dry dust of the darkest corners," and they will steal Wood Rats and White-footed Mice caught in the traps of collectors. Owing to the inaccessibility of their rock dens, and their nocturnal habits, they are seldom seen in the wild state. Mr. Bailey trapped a pair in one of the canyons of the Rio Grande and he says, "the male fought and screamed viciously as we approached, but the female was quiet and gentle. Even in the traps the animation and brightness of their faces were wonderful. The large ears, when directed forward, were in constant motion. The long, black, vibrating moustache, the striking black and light face markings, and, most of all, the big, soft, expressive eyes give a facial expression of unusual beauty and intelligence."

They feed on small rodents, birds, insects (including the centipede), and are not averse to fruit. Traps set for them are often baited with meat. Their nests, which are lined with moss, are placed in the hollows of trees, and there are usually three or four young in a litter. They are very easily tamed, and are made household pets by California miners and Texas ranchmen. The latter say that they make better mousers than domestic cats, and, if given free run of the premises, will lose no time in clearing a cabin of rats and mice.

THE WEASEL FAMILY

(*Mustelidæ*)

A NUMEROUS group of fur-bearers comprise the Weasel family, which is scattered all over the world, with the exception of Australia and Madagascar. They include Weasels, Badgers, Skunks, Minks, Otters, Martens and Wolverenes. They are small in size, some being quite diminutive, but as a rule are fierce and bloodthirsty. Their bodies are long and slender, their motions are quick and graceful, their strength and endurance prodigious. They have short, powerful legs with feet adapted to running, climbing, digging, burrowing, or swimming. Most members of the family take readily to the water. Other distinguishing traits are: a single tubercular molar tooth on each jaw; five-toed feet which are both plantigrade and digitigrade; absence of the cæcum; presence of anal musk glands which are more or less completely under control.

The members of this family differ widely in coloration. In some of the northern forms a single animal will change its dress from dark in summer to light in winter. Others, such as the Skunk, will have broad stripes of white contrasting with black or brown. Others, like the Otter, have fur of a uniformly dark tint; while a nearly related member will possess a coat of wonderful brilliance.

The wide range of colors coupled with the softness of the fur has made the members of this family of great economic importance. They are highly prized among furriers, some of the species bringing high prices.

AMERICAN WOLVERENE

Gulo luscus *Linnæus*

Other Names.— Glutton, Carcajou.

General Description.— A robust animal built like a small Bear and weighing 20 or 25 pounds. Tail bushy, short; soles hairy; ears short; claws strong, curved, partially retractile; fur moderately long; color blackish brown with lighter areas on face and along sides. Sexes alike. A very powerful animal for its size.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{1-1}{2-2}$=48.

Pelage.— General color deep blackish-brown, paler and grayer on crown and cheeks; band of pale chestnut from shoulder to tail where the two bands meet; nearly white on rump in some specimens; more or less yellowish white spots on throat and chest; claws whitish horn color. Little seasonal variation.

Measurements.— Length, male, 36 to 38 inches; tail, 7 inches; hind foot, 7 inches; ear, 2 inches. Weight, 25 pounds.

Range.— Arctic America south to northern United States, and in Rocky Mountains to Colorado.

Food.— Mammals and birds; any mammal it can kill and occasionally animals found dead.

Remarks.— The Wolverene is the largest member of the family to which it belongs, the family of the Martens and Weasels. It is a wide-ranging beast but is not found south of the regions of heavy snowfall. It remains unchanged to any very noticeable degree throughout a wide area and but three species are described.

Related Species

American Wolverene.—*Gulo luscus* Linnaeus. The typical species described above. Arctic and sub-Arctic America north of the United States, south in the Rocky Mountains to Colorado.

California Wolverene.— *Gulo luteus* Elliot. Color about buffy. California.

Alaska Wolverene.— *Gulo hylaeus* Elliot. Color very dark, without buff or gray. Found in various parts of Alaska.

The Wolverene, also known as the Glutton and Carcajou, has been the subject of more legends and quaint stories than almost any other animal. According to the Indians, it is inhabited by an evil spirit. The French Canadian also gave it strange characteristics, under the name of Carcajou. In fact, the myths clustering about this animal date back as early as the sixteenth century, in Europe. Olaus Magnus (1562), to whom is commonly attributed the earliest men-

Photograph by American Museum of Natural History

WOLVERENE

The Wolverene is thought by Indians and trappers to be possessed of an evil spirit, such demoniacal cunning does it exhibit. Many legends cluster about the Glutton, or Carcajou, as it is also called

tion, gives a most extraordinary account, made up of the then current popular traditions and superstitions, and tales of hunters or travelers, unchecked by any proper scientific inquiry; although, to do him justice, he does not entirely credit them himself. We may be sure that such savory morsels of animal biography did not escape the notice of subsequent compilers, and that they lost nothing of their flavor at the hands of Buffon. Probably no youth's early conceptions of the Glutton were uncolored with romance; the general picture impressed upon the susceptible mind of that period being that of a ravenous monster of insatiate voracity, matchless strength, and supernatural cunning, a terror to all other beasts, the bloodthirsty master of the forest.

These stories are highly absurd, says Coues, who describes the Wolverene as "simply an uncommonly large, clumsy, shaggy Marten or Weasel, of great strength, without corresponding agility, highly carnivorous, like the rest of its tribe, and displaying great perseverance and sagacity in procuring food in its northern residence when the supply is limited or precarious, often making long uninterrupted journeys, although so short-legged. It is imperfectly plantigrade, and does not climb trees like most of its allies. It lives in dens or burrows, and does not hibernate. It feeds upon the carcasses of large animals which it finds already slain, but does not destroy such creatures itself, its ordinary prey being of a much humbler character. It is a notorious thief, not only of stores of meat and fish laid up by the natives of the countries it inhabits, the baits of their traps, and the animals

so caught, but also of articles of no possible service to itself; and avoids with most admirable cunning the various methods devised for its destruction in retaliation."

The fur of the Wolverene is highly valued both by civilized and uncivilized people. A number of skins sewed together make a very beautiful carriage robe or hearth-rug, and the pelts are in common use for these purposes. The Indians and Esquimaux use the fur as they do that of the Wolf, for fringing their garments, the skin being in strips for this purpose.

The Wolverene ranges in greater or less abundance all over the northern portions of this country. It appears to be particularly numerous in the Mackenzie river region, and it fairly infests the whole country bordering the lower portions of this river and the west side of the mountains. From this country, many accounts from various officers of the Hudson's Bay Company bear witness to the wonderful cunning and sagacity of the beast, as well as its ferocity, and represent it to be the greatest enemy with which the hunters and trappers have to contend in the pursuit of fur-bearing animals.

To the trapper, Wolverenes are especially annoying. When they have discovered a line of marten traps they will never abandon the road, and must be killed before the trapping can be successfully carried on. Beginning at one end, they proceed from trap to trap along the whole line, pulling them successively to pieces, and taking out the baits from behind. When they can eat no more, they continue to steal the baits and cache them. If hungry, they may devour two or three of the martens they find captured, the remainder being carried off and hidden in the snow at a considerable distance. The work of demolition goes on as fast as the traps can be renewed.

The propensity to steal and hide things is one of the strongest traits of the Wolverene. To such an extent is it developed that the animal will often secrete articles of no possible use to itself. Besides the wanton destruction of traps, it will carry off the sticks and hide them at a distance, apparently in sheer malice. Mr. Ross has given an amusing instance of the extreme of this propensity: "The desire for accumulating property seems so deeply implanted in this animal, that, like tame ravens, it does not appear to care much what it steals so that it can exercise its favorite propensity to commit mischief. An instance occurred within my own knowledge in which a hunter and his family having left their lodge unguarded during their absence, on their return found it completely gutted — the walls were there but nothing else. Blankets, guns, kettles, axes, cans, knives and all the other paraphernalia of a trapper's tent had vanished, and the tracks left by the beast showed who had been the thief. The family set to work, and by carefully following up all his paths recovered, with some trifling exceptions, the whole of the lost property."

Fatal tragedies have occurred in pioneer camps, on account of such thefts — the man who suffered the loss of his goods often suspecting one of his human neighbors.

Though very clumsy, the Wolverene manages to capture, at times, such prey as hares or grouse, and successfully attacks disabled deer. It also feeds on offal or carrion; in fact, anything that it can catch or steal. Its own flesh is only eatable in the extreme of starvation. Wolverenes bring forth in burrows under ground, probably old bear washes, and have four or five young at a birth. It is very rarely that they are discovered at this period or while suckling their young. One reason, however, may be that they reproduce late in June and early in July, when the mosquitoes are so numerous that no one who can avoid it goes abroad in the woods. The mating season is in the latter part of March. The female is ferocious in the defense of her young, and if disturbed at this time will not hesitate to attack a man. Indeed, Indians have been heard to aver that they would sooner encounter a she-Bear with her cubs than a Carcajou under the same circumstances. In October, when the rivers set fast, the Wolverenes reappear in families, the young still following their dam, though now not much her inferior in size. They are full grown when about a year old. In early infancy, the cubs are said to be a pale cream color.

The ferocity of the Wolverene, no less than its cunning, is illustrated in some of the endless occasions on which it matches its powers against those of its worst enemy. A man had set a gun for a Carcajou which had been on his usual round of demolition of Marten traps. The animal seized the bait unwarily, and set off the gun; but owing to the careless or improper setting, the charge missed or only wounded it. The Carcajou rushed upon the weapon, tore it from its fastenings, and chewed the stock to pieces. It is added to the account of this exploit that the beast finished by planting the barrel muzzle downward in the snow; but this may not be fully credited. The stories that pass current among trappers in the North would alone fill

a volume, and they are quite a match for those that Olaus Magnus set down in his book centuries ago. But we need not go beyond the strict fact to be impressed with the extraordinary wit of the beast, whom all concur in conceding to be "as cunning as the very devil."

The Wolverene is almost exclusively nocturnal, there being but few instances of its having been seen abroad during the day; and it has been seen to sit up and shade its eyes with its paws, as if suffering from the unaccustomed light. It does not hibernate, and there is no marked difference in the color of the winter and summer coat. In spite of its clumsy-looking appearance the animal when disturbed can make off at a very rapid pace. It likewise ascends rough-barked trees with facility, although it is said that its climbing powers are only exerted when it scents food. In the pursuit of prey the Wolverene will readily swim rivers. As a rule it is silent, although when attacked it will give vent to angry growls.

These animals are found both solitary and in pairs, but generally solitary. During the day they live concealed in subterranean holes, which are usually their breeding-places, and which are frequently the deserted lairs of Bears. In North America the young are born in June or July, the number of individuals in a litter, as before stated, being generally four or five, but it has also been noticed by hunters that there are sometimes only two cubs.

AMERICAN MARTEN

Martes (= Mustela) americana (*Turton*)

Other Names.— Pine Marten, American Sable.

General Description.— A long, slender-bodied animal rather smaller than a house cat. Limbs short, digitigrade; tail moderate, inclined to be bushy; soles furred, pads naked; claws compressed, acute, semi-retractile; ears large; head roughly triangular with sharp nose; color above orange-brown, belly brownish, spot on breast orange. Habits arboreal.

PINE MARTEN

On account of their beautiful fur these Martens are so persistently hunted that they are now rare

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{1-1}{2-2} = 38$.

Pelage.— Sexes identical; young soon appearing as adults. Head grayish-brown, darkest on nose which is smoke brown; throat and spot on breast rich orange; general body color orange-brown clouded with black or blackish-brown on back and belly; legs, feet and upper part of tail black, underpart of tail rufous, save tip which is black. There is a considerable individual range of variation in color of pelage. Pelage same in winter as in summer. The hairs are soft and glossy and there is an under-fur of very soft short hair.

Measurements.— Length, 25 inches; tail, 8 inches; hind foot, 3¾ inches.

Range.— Boreal North America, west to Rocky Mountains, south to New York.

Food.— Largely squirrels, but also birds and their eggs, and at times other small mammals.

Remarks.— Owing to its particularly characteristic markings this animal should be confused with none of the other small fur-bearers. It is closely related to the Weasels and to the Minks. Eleven different forms of the American Marten are recognized; among these the following are prominent.

RELATED SPECIES

American Marten.— *Martes americana americana* (Turton). The typical species described above. Forested North America from New York to the Rocky Mountains, northward.

Saskatchewan Pine Marten.— *Martes americana abieticola* (Preble). Much larger. Saskatchewan, Canada.

Alaska Marten.—*Martes americana actuosa* (Osgood). Larger, grayer. Alaska.

Kenai Marten.— *Martes americana kenaiensis* (Elliot). Smaller, paler; lacking orange throat patch. Kenai Peninsula, Alaska.

Newfoundland Marten.— *Martes atrata* (Bangs). Larger; much darker, color deep chocolate. Newfoundland.

Labrador Marten.— *Martes brumalis* (Bangs). Larger and darker. Labrador.

Pacific Marten.— *Martes caurina caurina* (Merriam). Colors averaging darker; larger; throat spot orange red. Pacific Coast from San Francisco to Puget Sound.

The Martens in America have been given many names, due at first to the effort to distinguish them from their foreign kin. Although the American animal was known in very early times, long before it received a distinctive name, having been referred alternately to the European Pine Marten and Asiatic Sable, or to both of these species, very little definite information upon its range and habits was recorded for many years. Pennant, our principal early authority on the animals of the North American fur countries, considered it the same as *M. martes,* and drew its range accordingly. He states that it inhabits, in great abundance, the northern parts of America, in forests, particularly of pine and fir, nesting in the trees, bringing forth once a year from four to eight young; that its food is principally Mice, but also includes such birds as it can catch; that it is taken in dead-falls, and sometimes eaten by the natives. As an article of commerce in comparatively early times, we notice the sale of some 15,000 skins in one year (1743) by the Hudson Bay Company, and the importation from Canada by the French into Rochelle of over 30,000. "Once in two or three years," he adds, they "come out in great multitudes, as if their retreats were over stocked; this the hunters look on as a forerunner of great snows, and a season favorable to the chase." Such periodicity in numbers thus early noted is confirmed by later observations.

The Sable is ordinarily captured in wooden traps of very simple construction, made on the spot. The trap is a little enclosure of stakes or brush in which the bait is placed upon a trigger, with a short upright stick supporting a log of wood; the animal is shut off from the bait in any but the desired direction, and the log falls upon its victim with the slightest disturbance. A line of such traps, several to the mile, often extends many miles. The bait is any kind of meat, a Mouse, Squirrel, piece of fish, or bird's head. One of the greatest obstacles that the Sable hunter has to contend with in many localities is the persistent destruction of his traps by the Wolverene and Pekan, both of which display great cunning and perseverance in following up his line to eat the bait, and even the Sables themselves which may be captured. The exploits of these animals in this respect may be seen from the accounts elsewhere given. Hudson Bay trappers tell of a Sable road fifty miles long, containing 150 traps, everyone of which was destroyed throughout the whole line twice — once by a Wolf and once by a Wolverene. When thirty miles of this same road were given up, the remaining forty traps were broken five or six times in succession by the latter animal. The Sable is principally trapped during the colder months, from October to April, when the fur is in good condition; it is nearly valueless during the shedding in summer. Sometimes, however, bait is refused in March, and even earlier, probably with the coming on of the pair-

ing season. The period of full furring varies both in spring and autumn, according to latitude, by about a month as an extreme.

Although the Sable is persistently hunted, it does not appear to diminish materially in numbers in unsettled parts of the country. It holds its own partly in consequence of its shyness, which keeps it away from the abodes of men, and partly because it is so prolific; it brings forth six to eight young at a litter. Its home is sometimes a den underground or beneath rocks, but oftener the hollow of a tree; it frequently takes forcible possession of a Squirrel's nest, driving off or devouring the rightful proprietor. Though frequently called Pine Marten, like its European relative, it does not appear to be particularly attached to coniferous woods, living in them simply because such forests prevail to a great extent in the geographical areas it inhabits.

Photograph by O. J. Murie

AMERICAN MARTEN

Martens are still to be found in the dense forests of pine and spruce, but have been so persistently hunted for their fur, that they are extremely shy

"The Sable," says Coues, "is no partner in guilt with the Mink and Stoat in invasion of the farm-yard, nor will it, indeed, designedly take up its abode in the clearing of a settler, preferring always to take its chances of food supply in the recesses of the forest. Active, industrious, cunning and predaceous withal, it finds ample subsistence in the weaker rodents, insectivora and birds and their eggs. It hunts on the ground for Mice, which constitute a large share of its sustenance, as well as for Shrews, Moles, certain reptiles and insects. An expert climber, quite at home in the leafy intricacies of tree tops, it pursues squirrels, and goes bird's-nesting with success. It is said also to secure toads, frogs, lizards, and even fish.

"The Sable has some of the musky odor characteristic of its family, but in very mild degree compared with the Mink or Pole-cat. With a general presence more pleasing, it combines a nature, if not less truly predacious at least less sanguinary and insatiable. It does not kill after its hunger is appeased, nor does a blind ferocity lead it to attack animals as much larger than itself as those that the Stoat assaults with success. Animals like the Rabbit and Squirrel form less of its prey than the smaller rodents and insectivores. In confinement, the Marten becomes in time rather gentle. It is sprightly and active, with little unpleasant odor."

Merritt Cary, in "A Biological Survey of Colorado," says: "In the dense forests of lodgepole pine and spruce, which clothe the upper slopes of the higher mountain ranges of northern Colorado, the Marten is still present in considerable numbers. It appears to be uncommon on all the southern ranges except the San Juan Mountains, where from a point northeast of Pagoda Springs west of Silverton and Telluride it is reported in good numbers. Martens are rarely observed below 8,000 or 8,500 feet, or the lower edge of the Canadian zone forest belt. They range regularly to timberline, however, and have been seen 1,500 feet above timberline near Silverton. Throughout their range Martens are hunted and trapped extensively, and consequently are not nearly so abundant as formerly. Skis are often used in hunting them in winter, when snow covers the mountains to a depth of several feet, and when pursued in this manner the animals quickly take refuge in trees where they are easily shot. Hunting Martens on skis is said to be very exciting sport, and at times hazardous, owing to the roughness of the country. This is a favorite method of hunting in Middle Park and in the San Juan Mountains. Most of the Martens secured, however, are taken in either steel traps or dead-falls. Although Colorado Martens are somewhat paler than those farther north, they yield a valuable fur."

PENNANT'S MARTEN

Martes pennanti (*Erxleben*)

Other Names.— Fisher, Pekan, Black Cat.

General Description.— A Marten, but much larger than the Pine Marten. See description. Body long, lithe and powerful; weight up to 18 pounds. Legs short; head short; muzzle pointed; ears prominent; tail moderately bushy. Color brownish-black, lighter on sides, browner below.

Dental Formula.— Same as given for Pine Marten.

Pelage.— Color same the year around; sexes identical. Color variable, but dark. Some specimens are glossy black, including tail and underparts; others are gray or grayish-white on head and neck; the majority of individuals have more or less white on chin, chest and abdomen. In general the body color is grayish-brown or brownish-black, lighter on sides and browner on belly; darker on snout, ears, feet, and tail; ears with pale linings; claws whitish horn color.

Measurements.— Length, male, 36 inches; tail, 14 inches; hind foot, 4 inches. Weight, 8½ to 18 pounds. Female, smaller.

Range.— North America north of 35° in forest covered country, except on Pacific coast where the Pacific Fisher is found.

Food.— Mice, squirrels, hares, porcupines, birds and eggs. Only rarely fish.

Remarks.— Although the name Fisher is applied to this animal it is inappropriate inasmuch as the animal is not a fisherman. But two varieties of this Marten are recognized.

Related Species

Pennant's Marten, or Fisher.—*Martes pennanti pennanti* (Erxleben). The typical animal described above. Boreal North America north of 35° except on Pacific Coast.

Pacific Fisher.— *Martes pennanti pacifica* (Rhoads). Larger skull and upper molars; coloration in general darker. Various parts of the Pacific slope, California to Alaska.

The largest of all the Martens is an animal rejoicing in a number of names both popular and scientific, being variously designated as the "Pekan," "Fisher," "Pennant's Marten," "Black Fox," and "Black Cat." The two latter titles are due to the large size, stout build and dark color of the animal, which in point of form may be more aptly compared to a Fox than to a Weasel. Its general color is blackish brown, becoming gray on the head and neck; while the throat is distinguished by the absence of the light-colored patch distinctive of all the other species. It ranges over the greater part of North America, as far north as Alaska and south to the upper part of Texas. Continual hunting has, however, exterminated the animal from the more settled districts of the United States east of the Mississippi.

Dr. Merriam observes that "the name Fisher is somewhat of a misnomer, for these animals commonly frequent deep swamps and wooded mountain sides, away from the immediate vicinage of the water, and are not known to catch fish for themselves as do the Mink and Otter. However, they are fond of fish, and never neglect to devour those that chance to fall in their way. They prey chiefly upon hares, squirrels, mice, grouse, small birds and frogs, and are said to eat snakes. They also catch and feed upon their own congener, the Marten, and make a practice of devouring all that they discover in dead-falls and steel-traps. It also appears that Porcupines compose a considerable proportion of their food in some districts; specimens being sometimes killed with numbers of Porcupine-quills in their skin and flesh."

This Marten breeds but once a year; it brings forth its young in the hollow of a tree, usually thirty or forty feet from the ground. Two, three, and four young are produced in a litter. It has been known to offer desperate resistance in defense of its young, as on one occasion mentioned by Audubon. This animal, a young one, was kept in confinement for several days. "It was voracious, and very spiteful, growling, snarling and spitting when approached, but it did not appear to suffer much uneasiness from being held in captivity, as, like many other predacious quadrupeds, it grew fat, being better supplied with food than when it had been obliged to cater for itself in the woods." Another mentioned by the same author as having been exhibited in a menagerie in Charleston, S. C., some months after its capture, continued sullen and spiteful, hastily swallowing its food nearly whole, and then retiring in growling humor to a dark corner of its cage. Hearne, however, has remarked that the animal is easily tamed, and shows some affection at times. When taken very young, it may become perfectly tame, and as playful as a kitten. The Pekan is sometimes forced, by failure of other sources of supply, to a vegetarian diet, when it feeds freely upon beechnuts.

One hunter thus describes an encounter with this animal. "A servant, on one occasion, came to us before daylight, asking us to shoot a Raccoon for him, which, after having been chased the previous night, had taken to so large a tree that he neither felt disposed to climb it nor cut it down. On our arrival at the place, it was already light, and the dogs were barking furiously at the foot of the tree. We soon perceived that instead of being a Raccoon, the animal was a far more rare and interesting species, a Fisher. As we were anxious to study its habits we did not immediately shoot, but teased it by shaking some grape vines that had crept up nearly to the top of the tree. The animal not only became thoroughly frightened, but furious; he leaped from branch to branch, showing his teeth and growling at the same time; now and then he ran half-way down the trunk of the tree, elevating his back in the manner of an angry cat, and we every moment expected to see him leap off and fall among the dogs. He was brought down after several discharges of the gun. He seemed extremely tenacious of life, and was game to the last, holding on to the nose of a dog with a dying grasp. The animal proved to be a male; the body measured twenty-five inches, and the tail, including the fur, fifteen. The servant who had traced him informed us that he appeared to have far less speed than a Fox, that he ran for ten minutes through a swamp in a straight direction and then took to a tree.

"Species that are decidedly nocturnal in their habits frequently may be seen moving about by day during the period when they are engaged in providing for their young. Thus the Raccoon, the Opossum, and all our Hares, are constantly met with in spring, and early summer, in the morning and afternoon, while in autumn and winter they only move about by night. In the many Fox hunts, in which our neighbors were from time to time engaged, not far from our residence at the north, we never heard of their having encountered a single Fisher, in the daytime; but when they traversed the same grounds at night, in search of raccoons, it was not unusual for them to discover and capture this species. We were informed by trappers that

they caught the Fisher in their traps only by night."

In its chiefly nocturnal and largely arboreal habits the Fisher Marten resembles most of the other members of the group; its agility in the forests is, however, very remarkable, and when much frightened, or in pursuit of prey, it has been known to leap from tree to tree. The nest, as before stated, is usually built in the hole of a tree at a great height above ground; the young being generally born at the end of April or beginning of May.

The Fisher is trapped for its skins in the northern parts of America from October till May, those captured in the early part of the season being in the best condition.

ARCTIC WEASEL

Mustela (= Putorius) arctica (*Merriam*)

Other Names.— Ermine, Stoat.

General Description.— A very small, slender and long-bodied Carnivore. Legs short; tail long, moderately bushy, black at the tip; ears of moderate size; soles haired; general color in summer, yellowish-brown above, under parts yellow; in winter white everywhere except for black tipped tail. Females much smaller than males.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{1-1}{2-2} = 34$.

Pelage.— Adults: *Summer.* Upper parts and upper lip dark yellowish brown; chin white; under parts, inner sides of limbs, fore feet and under side of tail deep ochraceous yellow; tail above like body except for terminal half which is black. *Winter.* Everywhere white except for black pencil on tail. Pelage made up of two coats, long hard hairs and a shorter, softer coat of underfur.

Measurements.— Length, male, 15 inches; tail, 7 inches; hind foot, 2 inches. Females about one-seventh smaller.

Range.— Arctic coast and tundras.

Food.— Strictly carnivorous, principal diet mice, hares and small birds.

Remarks.— Nearly all the Weasels have the same general type of coloration and practically all found in regions of moderate to heavy annual snow fall turn white in winter; only those found in warm regions retain throughout the year the brown summer coat. This group is a large one and contains many forms differing from one another in color, size and internal structure. In all some thirty species and sub-species of Weasels are now recognized by the best authorities, but only a few of the more distinct and well-known species are listed below.

Related Species

Arctic Weasel.— *Mustela arctica arctica* (Merriam). One of the larger Weasels. See description above. Arctic coast and tundras.

Bonaparte's Weasel.— *Mustela cicognanii cicognanii* Bonaparte. Size small; tail short. Forested North America from New England and Labrador to coast of southeastern Alaska, south into Rocky Mountains to Colorado.

Richardson's Weasel.— *Mustela cicognanii richardsonii* (Bonaparte). Larger than Bonaparte's Weasel. Timbered belt from Hudson Bay to interior of Alaska and British Columbia.

Mountain Weasel.— *Mustela arizonensis* (Mearns). Similar to New York Weasel. Sierra Nevada and Rocky Mountains from Arizona into British Columbia.

Long-tailed Weasel.— *Mustela longicauda longicauda* Bonaparte. Size large, tail long. Great Plains from Kansas northward.

Cascade Weasel.— *Mustela saturata* (Merriam). Color dark. Cascade and Siskiyou Mountains of Oregon and Washington northward into British Columbia.

Yellow-throated Weasel.— *Mustela xanthogenys xanthogenys* Gray. Size large, white spot on head and between eye and ear. Sierra Nevada, southern California.

New York Weasel.— *Mustela noveboracensis noveboracensis* (Emmons). See description below.

Bridled Weasel.— *Mustela frenata frenata* Lichtenstein. See description below.

Least Weasel, or Pygmy Weasel.— *Mustela rixosa rixosa* (Bangs). See description below.

The Weasel tribe is numerous and widely distributed, both in this country and in Europe. It contains members differing greatly in size, color and structure. In size it ranges from the New York Weasel, about sixteen inches long, to the Pygmy Weasel, about seven inches. There are, in fact, some thirty species and sub-species now recognized, but the general habits are similar.

Wherever found, it is a bold and inquisitive animal, exhibiting but little fear of man, and poking out its nose from some hole or cranny with the greatest indifference and self-possession. In spite, however, of this curiosity, the Weasel is ever on the alert to withdraw its head at the slightest symptom of attack. Its normal gait is a series of small leaps, stopping at intervals to take a careful survey of its surroundings, and not unfrequently rising on its haunches to obtain

Photograph by William L. Finley

MOUNTAIN WEASEL

A species very similar to the New York Weasel, found in the Northwest. Photograph about one-half life size

a better view. From its elongated, almost snake-like, body it can follow most of the small mammals on which it preys into their holes.

A graceful little bundle of muscle, combined with courage and cunning of a high order — such is the American Ermine, or Arctic Weasel, whose fur is so highly prized. Dr. Coues gives him a quality of courage and resourcefulness, far above the large carnivora: "No animal or bird, below a certain maximum of strength or other means of self-defense, is safe from his ruthless pursuit. The Ermine assails them not only upon the ground, but under it, and on trees, and in the water. Swift and sure-footed, he makes open chase and runs down his prey; keen of scent, he tracks them, and makes the fatal spring upon them unawares; lithe and of extraordinary slenderness of body, he follows the smaller animals through the intricacies of their hidden abodes, and kills them in their homes. And if he does not kill for the simple love of taking life, he at any rate kills instinctively more than he can possibly require for his support. I know not where to find a parallel among the larger carnivora."

ERMINE, OR ARCTIC WEASEL

A dominant trait of this beautiful fur-bearer is curiosity

A glance at the Weasel suffices to betray its dominant traits. The teeth are almost of the highest known raptorial character; the jaws are worked by enormous masses of muscles covering all the side of the skull. The forehead is low, the nose sharp; the eyes are small, penetrating, cunning, and glitter with an angry green light. "There is something peculiar, moreover, in the way that this fierce face surmounts a body extraordinarily wiry, lithe and muscular. It ends a remarkably long and slender neck in such way that it may be held at right angle with the axis of the latter. When the creature is glancing around, with the neck stretched up, and flat triangular head bent forward, swaying from one side to the other, we catch the likeness in a moment. It is the image of a serpent."

Audubon, one of our earliest and most careful observers, thus describes the Ermine: "Graceful in form, rapid in his movements, and of untiring industry, he is withal a brave and fearless little fellow; conscious of security within the windings of his retreat among the logs, or heap of stones, he permits us to approach him within a few feet, then suddenly withdraws his head. We remain still for a moment, and he once more returns to his post of observation, watching curiously our every motion; seeming willing to claim association so long as we abstain

from becoming his persecutor. Yet with all these external attractions, this little Weasel is fierce and bloodthirsty, possessing an intuitive propensity to destroy every animal and bird within its reach, some of which, such as the American rabbit, the ruffed grouse and domestic fowl, are ten times its own size. It is a notorious and hated depredator of the poultry house, and we have known forty well grown fowls to have been killed in one night by a single Ermine. We have traced the footsteps of this bloodsucking little animal on the snow, pursuing the trail of a fleeing rabbit, and although it could not overtake its prey by superior speed, yet the timid Hare soon took refuge in the hollow of a tree, or in a hole dug by the Marmot or Skunk. Thither it was pursued by the Ermine and destroyed, the skin and other remains at the mouth of the burrow bearing evidence of the fact."

TWO VIEWS OF THE ERMINE

Showing the summer and winter coats of an animal whose fur is greatly desired

The Weasel can be employed, in the manner of a Ferret, in driving Rabbits from burrows. In one instance the Ermine employed had been captured only a few days before, and its canine teeth were filed, in order to prevent it destroying the Rabbit. A cord was placed around its neck to secure its return. It pursued the Hare through all the windings of its burrow, and forced it to the mouth, where it could be taken in a net, or by the hand.

The color of the fur in summer is of a reddish-brown above and sulphur-white below. In the northern latitudes the color change is very marked. In the late autumn the coat is shed very rapidly and replaced by a much longer and denser white one for winter, except the tip of the tail, which is black.

The nature of the change from the dark summer to the white winter dress has given rise to much discussion. It was originally considered that the animal sheds its coat in the autumn and spring; the dark summer coat being gradually replaced by the advent of the white hairs of the winter one. Doubts then arose whether the change in color was always coincident with the development of the winter and summer coat, and whether the hairs themselves might not actually change color. Dr. Coues succeeded, however, in proving that the change might take place in either way, some specimens taken in spring showing the long, woolly white winter coat on some parts of the body, while on other parts they had the short, coarse, brown hair of summer; and he observes that "we may safely conclude that if the requisite temperature be experienced, at the periods of renewal of the coat, the new hairs will come out of the opposite color; if not, they will appear of the same color, and afterwards change; that is, the change may or may not be coincident with the shedding." Dr. Coues attributed the reason of the color-change entirely to the effect of temperature; but strong objection is taken to this view by Dr. Merriam, who observes that it occurs in captive specimens kept continually in warm rooms. Dr. Merriam, however, states that the winter change never takes place till after the first fall of snow, which generally occurs towards the end of October or the beginning of November. Although the temperature of the air may be much lower before than subsequent to this first snowfall, yet it is true "that Ermine caught up to the very day of the first appearance of snow bear no evidence of the impending change. Within forty-eight hours, however, after the occurrence of the snowstorm the coat of the Ermine has already commenced to assume a pied and mottled appearance, and the change now commenced progresses to its termination with great rapidity. In early spring, the period for the reversal of this process, the changing back from its white coats of winter to the brown summer coat is determined

by the same cause — the presence or absence of snow."

Like a majority of predatory animals, the Weasel is nocturnal in its habits. Nevertheless, it is too often abroad in the daytime, either in sport or on the chase, to be classed among the truly nocturnal animals. In the choice and construction of its retreats we see little evidence of burrowing instincts. It retreats beneath stone heaps in dense thickets, under logs and stumps, in hollow trees, and also in burrows, though these are usually those made by other animals that it has driven off or destroyed. Nevertheless, there is evidence that it sometimes digs.

Captain Lyon states that he observed a curious kind of a burrow made by Ermines in the snow "which was pushed up in the same manner as the tracks of moles through the earth. These passages ran in a serpentine direction, and near the hole or dwelling place the circles are multiplied, as if to render the approach more intricate."

Photograph by the U. S. Biological Survey

BONAPARTE'S WEASEL

The Weasel is a skilful climber, darting along the limbs of trees with the nimbleness of a Squirrel

Audubon has a passage of similar effect: "We have frequently observed where it has made long galleries in the deep snow for twenty or thirty yards, and thus in going from one burrow to another, instead of traveling over the surface, it had constructed for itself a kind of a tunnel beneath."

NEW YORK WEASEL

Mustela noveboracensis (*Emmons*)

General Description.— See Arctic Weasel. One of the larger Weasels of the United States. Dark in color, in summer, and with a long tail, usually one-third entire length. Black tips.

Dental Formula.— Same as Arctic Weasel.

Pelage.— *Summer*, dull brown on upper side gradually shading into white on under side. *Winter*, pure white except tip of tail.

Measurements.— Male larger than female; length usually 16 to 18 inches for male, and 12 or 13 inches for female.

Range.— Eastern United States from Maine to Illinois.

Food.— Small mammals, birds, grasshoppers, and any other living flesh that it can secure. No vegetable matter.

One of the best known Weasels, because living near home to many Eastern people, is the New York Weasel. Its habits resemble other related species, one of its nearest relatives being the Mountain Weasel of the West. The New York Weasel is to be found from Maine to the Mississippi River. It is one of the larger types, being about sixteen inches long. It is dull brown in color above, and white below, changing to white in winter, except for the final one-third of the tail, which remains black.

Despite its destructive habits, this Weasel is rather a benefactor than an enemy to the farmer, ridding his granaries and fields of many prowlers. A mission appears to have been assigned to it by Providence to lessen the rapidly multiplying number of mice and the small rodentia. Wherever the Weasel appears, the mice for half a mile around rapidly diminish in number. Their enemy is able to force its thin vermiform body into the burrows, it follows them to the end of their granaries, and destroys whole families.

Dr. Coues thus observes: "We once placed a half-domesticated Weasel in an outhouse infested with Rats, shutting up the holes on the outside to prevent their escape. The animal soon commenced his work of destruction. The squeaking of the Rats was heard through the day. In the evening, it came out licking its mouth, and seemed like a hound after a long chase, much fatigued. A board of the floor was raised to enable us to ascertain the result of our experiment, and an immense number of Rats were observed, which, although they had been killed in different parts of the building, had been dragged together, forming a compact heap."

A better character, however, is given by a recent observer, Mr. S. A. Lottridge, who says: "I do not believe that the normal Weasel is as bloodthirsty as many would lead us to think, but rather his physical condition must answer for his superfluous killing. My experiments with Weasels extended over a period of several years. Under an old barn I had a Weasel house which was made mouse tight, a ground space ten by fifteen feet. Connecting with this by means of small doors were two other smaller compartments, also mouse tight. The house was fitted up as an ideal place for a Weasel's home: there were hollow logs, a stone pile, and plenty of dry leaves and moss. The experiments were tried at nightfall, as results were more quickly obtained, since the Weasel is largely nocturnal.

"In one of the experiments there were placed in one of the compartments an old rabbit and four small ones, and in the other compartment three chickens. Late in the evening the compartments were examined and not a rabbit or a chicken was found alive, and the remains had been left just where the victims had fallen. No attempt was made by this Weasel to hide the bodies for future use. The Rabbits were killed by a single bite, except the old one, which was bitten twice in the neck. The brains of two of the young rabbits were eaten. At another time, another Weasel killed six young rabbits and six chickens in a single night.

"In experimenting with several other Weasels the number of animals killed was large, except in two instances which I will cite later, but there was a marked difference in the number of brains consumed and the amount of flesh eaten. By regulating the food supply I found that the first choice was blood, next the brains, and then the flesh. Why this is the order I will attempt to demonstrate. By accident I discovered in the stomach of a Weasel a large parasite. As this was noted several times in other Weasels, it occurred to me that perhaps the parasite was the cause of such an abnormal ferocity and love for blood. I accordingly set about a definite investigation, with the result that out of twelve Weasels examined, I found but two without the parasites.

"At last a beautiful male Weasel occupied the house. On several occasions he left both chickens and rabbits in the compartments for two nights without killing them, and of ninety per cent of the animals he killed in six months portions of the bodies were eaten. Upon the dissection of this Weasel no parasite was found. Some time later another Weasel without the parasite behaved in the same manner. A Weasel which was trapped and brought to me dead had no parasite, but the stomach contained much solid food.

"I noticed with the Weasels having parasites that they were not in as fine a condition as those not having them. The fur in many cases showed a marked difference, being thicker and more glossy in those without the parasites. The length of the parasites varied from six to nine and a half inches. This seems to point to one conclusion, that the parasite in the Weasel's stomach is one cause for its choice of food and the blind ferocity that stamps the animal as a bloodthirsty little villain."

When angered the Weasel emits a penetrating and disagreeable odor, common to its family.

The mother Weasel's courage in defending her young against all odds is well known. The nest is constructed of dry leaves or moss in a stone heap, or log pile, or hollow log. There are two or three litters each year, with four or five young at a birth.

The young develop very rapidly and soon learn to shift for themselves. The following anecdote by an observer testifies to this fact: "I was walking through a park one day early in the autumn, when I noticed that the dead leaves under a tree were tossing and tumbling about in a curious manner. On going a little closer I found that a mother Weasel and her little ones were playing together. When I came up, of course, they all ran away. So I ran after them, and caught one of the little animals by putting my foot on it, just hard enough to hold it down on the ground without hurting it. And immediately the little creature, which was only about six inches long, twisted itself around, and drove its sharp teeth into the edge of the sole of my shoe, both from above and below. So that if I had done what I thought of doing at first and had stooped to pick it up, its teeth would certainly have met in my finger."

The Weasel is a skilful climber, darting along the limbs of trees with the nimbleness of a Squirrel. Not content with seeking its prey on the ground it will pursue birds through the trees.

Dr. A. K. Fisher says, "The Weasel is one of Nature's most efficient checks upon the hordes of meadow mice and other rodents, which at times destroy forage, crops, orchards, vineyards, and garden produce. It feeds also upon rabbits, squirrels, and birds, and in many sections its occasional inroads on the poultry yard have brought it into serious disrepute. It is, of course, desirable to kill particular individuals which have acquired the poultry habit, but farmers and horticulturists will make a mistake if they systematically destroy Weasels."

Photograph by H. T. Middleton

NEW YORK WEASEL

The Weasel's body is long, and its legs are set so far apart that they seem to work independently

The Mountain Weasel is tolerably common in the mountainous parts of the West, and replaces the Long-tailed Weasel from the eastern base of the foothills westward. It has a wide vertical range and occurs on both slopes of the Continental Divide from 5,000 feet to timberline.

It frequents the piles of large bowlders and debris in canyon bottoms and along mountain streams, where it preys chiefly upon Mice, Chipmunks, and Say Spermophiles. When surprised in the open, it immediately seeks refuge among the nearest rocks, but once in its safe retreat, its curiosity overcomes its fear, and it is seldom out of sight for more than a moment.

BRIDLED WEASEL

Mustela frenata *Lichtenstein*

General Description.— See general description for Arctic Weasel. Larger in size; tail longer and pattern of coloration distinctly different; color in general dark chestnut brown to black, with conspicuous white patch across forehead; below, ochraceous yellow to orange.

Dental Formula.— Same as given for Arctic Weasel.

Pelage.— ADULTS: Same pelage in winter as in summer. Top of head varying from dark chestnut brown to black; rest of upper parts rich brown; band across forehead including eyes and extending back to ear white; chin and throat whitish; rest of under parts ochraceous yellow to orange; front feet to above wrists whitish yellow to orange; inner sides of hind legs and hind feet yellow or orange; tail like back above and below, with restricted black tip.

Measurements.— Male, 18 to 20 inches; tail, 7 to 8 inches; hind foot, 2 inches.

Range.— Southern Texas into Mexico.

Food.— Small mammals and birds, anything that it can capture.

The Bridled Weasel lives at the other extreme of our country from the Ermine. While the latter ranges from the Canadian border to the Arctic coast, thus deriving its name of Arctic Weasel, the Bridled Weasel is found principally along our southern border and in the interior of Mexico.

It is a handsome little beast with tawny coat, as befits its life in a warmer zone, but it apparently has lost none of the activity of its northern cousin. The coat is a rich chestnut, shaded with dull brown or black, and, unlike the northern varieties, it does not turn white in winter. Where it lives, with winter almost devoid of snow, there is no need of this change, and Nature does not believe in doing useless things.

The Bridled Weasel is about eighteen inches long, sometimes longer, and is thus one of the largest species. Like other Weasels it is bloodthirsty, pursuing rodents and birds relentlessly. It pays no attention to other food, and is especially noted for its ferocity. Indeed, if such Weasels were of larger size they would be among the most dreaded of animals.

By permission of the U. S. Biological Survey

BRIDLED WEASEL

Drawing of head, showing characteristic markings from which this animal gets its name

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LEAST, OR PYGMY WEASEL

Mustela rixosa (*Bangs*)

General Description.— See Arctic Weasel. Smallest of the Weasels and smallest living carnivore. Tail without black tip and very short.

Dental Formula.— Same as Arctic Weasel.

Pelage.— *Summer*, upper parts reddish-brown, lower parts, white. *Winter*, entirely white.

Measurements.— Males, 7 inches long; females, 6 inches long.

Range.— Arctic America from Alaska to Hudson Bay, and south to Minnesota and Montana.

Food.— Strictly carnivorous. Small mammals and birds wherever found.

The Pygmy, or Least Weasel, is so-called because it is the smallest of the Weasels and the smallest of all flesh-eating mammals. Because of its flesh diet it is exceedingly fierce, being known to attack animals nearly twice its size without provocation.

The Pygmy Weasel is only seven inches long, or less. In color it is reddish brown on the back and white on the belly. In winter it is entirely white. Its tail lacks the usual black tip which marks the Ermine. It ranges over the greater part of Canada from the coast of Alaska

to Hudson Bay, and south as far as Minnesota and Montana.

Its white coat in winter coupled with its diminutive size makes it extremely hard to follow through the snow. An observer says: "One would suppose that this beautiful white fur of winter, literally as white as the snow, might prove a disadvantage at times by making its owner conspicuous when the ground is bare in winter, as it frequently is even in the North; yet though Weasels are about more or less by day, you will seldom catch so much as a glimpse of one at such times, though you may hear their sharp chirrup close at hand. Though bold and fearless, they have the power of vanishing instantly, and the slightest alarm sends them to cover. I have seen one standing within reach of my hand in the sunshine on the exposed root of a tree, and while I was staring at it, it vanished like the flame of a candle blown out, without leaving me the slightest clue as to the direction it had taken. All the Weasels I have ever seen, either in the woods or open meadows, disappeared in a similar manner. How hawks, owls or foxes ever succeed in catching them is a mystery, yet they do from time to time, though certainly not often enough to reduce the number of Weasels at any season."

Mr. D. Costello relates an incident which occurred many years ago while he was prospecting in the mountains of northern Gunnison County, Colorado, back of Crested Butte. Soon after locating in a cabin adjacent to a large rock slide just below timberline, he discovered that a Cony was occupying a large grass nest beneath the cabin floor. It often appeared in the cabin, coming up through a broken board in the floor, and in time became very friendly. Finally a day came when the Cony did not make its usual appearance, but a tiny Weasel was seen at the hole in the broken board, peering in all directions and craning its long slim little neck with the bold curiosity so characteristic of the larger Weasels. Fearing for the welfare of the Cony, Mr. Costello killed the tiny cut-throat, but apparently too late, as he saw no more of his interesting companion. It seems probable that the Cony is often preyed upon by this Weasel, as the same rock slide has frequently been found to harbor both animals.

BLACK-FOOTED FERRET

Mustela (= Putorius) nigripes (*Audubon and Bachman*)

General Description.— Largest of the Weasel group. See general description of Arctic Weasel. Form like that of Arctic Weasel, but much larger in size, and body proportionately heavier; muzzle short; ears short, broad at base, closely furred; tail about ⅓ length of head and body; color above, reddish-brown; below, white; end of tail black.

Dental Formula.— Same as that given for Arctic Weasel.

Pelage.— Adults: No seasonal variation. Color above, rather reddish-brown with a dark area along the back and with hairs white at the roots; underfur white, tinged with yellow, showing through the brown hairs to give a buffy appearance; sides and rump lighter fading to yellowish-white; nose, ears, sides of head, throat and under surface of neck, belly and under surface of tail white; chest between fore legs brownish; a broad black patch on forehead inclosing eyes and reaching tip of nose; legs to shoulders and to hips brownish black; terminal two inches of tail black.

Measurements.— Length, male, 19 inches; tail, 4 inches; hind foot, 2½ inches. Female, length, 18 inches.

Range.— Great Plains from western North Dakota and northern Montana south to Texas.

Food.— Small mammals, but principally Prairie Dogs and probably a few small birds.

The Black-footed Ferret is a true Weasel, but differs from the other members enough to be placed in a group by itself. Its characteristic markings, the bright yellowish tone of the upper parts, the black across the face and the black feet, together with its large size, are sufficient to enable it to be instantly separated from any of its kindred. It does not change color in winter. There is but the one species known, a pretty little animal living out in the Western States in the Rocky Mountain country.

In 1849 it was described and pictured by Audubon and Bachman, but soon afterward naturalists seemed to lose sight of it, for little more was heard of it for thirty or forty years.

Locally it is known as the Prairie Dog Hunter, or Prairie Dog Ferret, as it seems especially fond of that fat little beast — much, however,

to the latter's distress. It is most often found in the holes of the defunct Dogs upon which it has feasted.

Very little is known as to the habits or life history of this animal, which seems chiefly remarkable for its ability to escape observation. Like all of the Weasel clan it is strictly a flesh-eater. There are no Fridays on its church calendar and no vegetarians among its friends. Failing in its supply of Prairie Dog steak, it assiduously hunts the Field Mice and other small mammals, as well as birds and their eggs.

Mr. Merritt Cary, in "A Biological Survey of Colorado," says: "This rare and little known animal has been recorded from a number of localities on the plains of eastern Colorado, but here, as elsewhere over its range, its numbers are small. Usually it is found in Prairie Dog towns, where it takes up its abode in an abandoned burrow, and from this convenient base preys upon the defenseless inhabitants of the colony. These Ferrets are most beneficial mammals, because their prey consists largely of Prairie Dogs."

Two specimens were captured at a height unusual for this plains mammal. Warren says: "One specimen in my collection came from Divide, Teller County, at an elevation of 9800 feet, another was found dead in Lake Moraine, El Paso County, altitude 10,250 feet. It is a mystery how the animal came there, and when skinned there were no marks on its body to indicate the cause of death."

By permission of the New York Zoological Society

BLACK-FOOTED FERRET

A member of the Weasel family that is little known because of its elusive habits. It is sometimes found in Prairie Dog burrows

Others have been recorded by Coues. All were taken in Prairie Dog towns, and one specimen had been drowned out of a Prairie Dog hole and captured alive. This individual was kept in confinement for some time. "It became quite tame, readily submitting to be handled, though it was furious when first caught. It was kept in a wire cage and fed on beef. When irritated it hissed and spat like an angry cat. It used to hide by covering itself over with material of which its nest was composed, but at times, especially at night, it was very active and restless."

AMERICAN MINK

Mustela vison *Schreber*

General Description.— Body Weasel-like; heavier and considerably larger than a Weasel; legs short; head broadly triangular in shape; tail about ⅓ length of body, bushy; ears short; soles hairy; foot pads naked; five toes in front and behind. Females considerably smaller than males. General color dark brown.

Dental Formula.— Same as that given for Weasel.

Pelage.— Adults: No marked seasonal variation. Pelage is composed of a long outer coat formed of hard, lustrous hairs and a shorter denser coat of soft under hairs dark in color like the longer coat but generally lighter in tone; above, nearly uniform umber brown, darker and glossier on the back, and on the tail, becoming nearly black; chin more or less white, and occasionally irregular white spots on throat, breast or belly. Young: Not quite as dark as adults and at first lacking the long shining hairs of the outer coat.

Measurements.— Length, male, 24 inches; tail, 7 inches; hind foot, 2½ inches. Weight, 2 pounds. Females, smaller; weight, 1 pound 10 ounces.

Range.— Central North America from eastern Canada to the Rockies.

Food.— Small mammals, birds and their eggs, fish, crayfish, mussels and clams.

Remarks.— The Mink seems to be midway in its development between the Weasel and the Otter, having a good many characters in common with either animal. The Minks of North America have not become differentiated into as many different forms as have the Weasels, and the Mink from Florida has almost precisely the same appearance as has the one from Alaska, there being only a slight size and color difference. About ten species and sub-species are known.

Related Species

American Mink.— *Mustela vison vison* Schreber. The typical animal of the above description. From eastern Canada to the Rocky Mountains through central North America.

Western Mink.— *Mustela vison energumenos* (Bangs). Larger and darker than the American Mink. Western North America from northern California to Arctic regions and east to Saskatchewan.

Alaska Mink.— *Mustela vison ingens* (Osgood). Very large and rather dark. Alaska.

Florida Mink.— *Mustela lutensis* (Bangs). Smaller than American Mink, tail shorter; color paler, more yellowish. Florida.

In both Europe and America, the Mink is semi-aquatic, being commonly at home in districts where water is found. In its water-loving propensities, it may be regarded as bearing the same relationship to the Polecat as is held by the Water-Vole to the Land-Vole. "The Mink," writes Dr. Merriam, "not only swims and dives with facility, but can remain long under water, and pursues and captures fish by following them under logs or other places from which there is no escape. It has thus been known to catch as swift and agile a fish as the brook-trout, and Audubon says that he has seen a Mink catch a trout of upwards of a foot in length. It is remarkably strong for so small an animal, and a single one has been known to drag a mallard duck more than a mile, in order to get to its hole, where its mate joined in the feast." Generally, the food of the Mink consists of various aquatic creatures, such as frogs, crayfish, and molluscs; but it will also eat various small aquatic mammals, such as voles, as well as mice and rats. Marsh-frequenting birds also fall victims to the Mink, and their eggs are probably also consumed. Other wild birds are, however, comparatively safe from the attacks of this animal, as its climbing powers are of the feeblest. Poultry are not unfrequently attacked; but in these and other attacks the Mink does not exhibit that wholesale destructiveness characteristic of the Ermine. In hunting, the Mink has been often observed to pursue its prey entirely by scent; and it may be observed on its hunting expeditions both by night and by day.

As a rule, Minks appear to be comparatively solitary animals; rarely are more than two seen in company. The abode of the Mink is usually a hole in the bank of a stream or lake; and a well-trodden path always leads from the entrance of the burrow down to the water. From such abiding places the animal will not only make daily excursions for the sake of procuring food, but also wander into neighboring districts, from which it sometimes does not return till after the lapse of a week or two.

Minks have been extensively bred in captivity for the purpose of being used as Ferrets, and in this condition it appears that the number of young in a litter may vary from three to as many as ten. The scent characteristic of all the members of the Weasel group is extraordinarily developed in the Mink, Dr. Coues observing that no animal, with the exception of the Skunk, possesses such a powerful, penetrating and lasting effluvium.

All who have hunted the Mink bear witness to its extraordinary tenacity of life, the writer last

quoted stating that he has known several instances of these animals being found alive after having lain for fully four-and-twenty hours with their bodies crushed flat beneath a heavy log. The countenance of the Mink is described as at all times far from prepossessing; but when alive in a steel-trap, these animals are said to have an expression almost diabolical.

A recent writer narrates an incident showing that the Mink is a formidable enemy of the Musk-Rat, though yielding to the latter in weight. While snipe-hunting on a marshy island below the Kickapoo Rapids of the Illinois River, the writer noticed an object, which appeared like a ball some six or eight inches in diameter, rolling toward the water. It was a Mink and a Musk-Rat clinched together, and so completely covered with mud as not to have been at first recognized. At his approach, the Mink released its hold and made its escape; but the Musk-Rat was already dying of severe wounds in the head and neck, from which the blood was flowing profusely. The rodent had evidently been captured and overcome in fair fight by broad daylight, and the Mink would have devoured its victim had not the hunter interfered.

By permission of the New York Zoological Society

MINK

The Mink swims and dives with ease, hunting fish, frogs and other aquatic food. It is also fond of birds' eggs, but its climbing powers are feeble

Mr. Charles Hallock remarks that he has known Minks to carry off fish weighing no less than twelve pounds: "We were spending our vacation in the woods of Maine, fishing and traveling about for a good time in general. One day we came across an old dam made to flood a piece of lowland. As this looked like a good place to fish we stopped, seated ourselves upon the edge of the dam, and cast in our line. The fish were quite plenty, and as soon as we caught one we threw it behind us upon the scaffolding. After a dozen or so had been caught, I thought I would light my pipe, pick up the fish and put them in the shade, and I started to do so. I accomplished the first object, but upon looking for the fish I could not find a single one. I thought that my chum must have removed them, and was playing a joke upon me, but on mentioning it to him, he was as much surprised as I was. They could not have fallen through the cracks, nor leaped over the side without our knowing it. Where were they? That was the question. He returned to fish, and I seated myself upon the bank to digest the subject. Presently he caught another fish and threw it upon the boards. Immediately I saw a Mink run out from a hole near by, snatch the fish and carry it off. This explained the mysterious disappearance of the others."

"The movements of the Mink on land," says Coues, "though sufficiently active, lack some-

thing of the extraordinary agility displayed by the more lithe and slender-bodied Weasels, as a consequence of the build of its body; while, for the same reason, it does not pursue the smaller animals into their extensive underground retreats, nor so habitually prowl about stone heaps and similar recesses. It is altogether a more openly aggressive marauder, though not less persistent and courageous in its attacks. It appears to be more perfectly at home in the water, where it swims with exactly the motions of an Otter, and in fact appears like a small specimen of that kind. It swims with most of the body submerged — perhaps only the end of the nose exposed — and progresses under water with perfect ease, remaining long without coming to the surface to breathe."

The Mink is not properly a migratory animal. In most sections it remains permanently where it takes up its abode. In others, however, it may be forced to remove at times, owing to scarcity or failure of its food-supply, such as may ensue from the freezing of the waters in northern parts. Under such circumstances, it may perform extensive journeys overland. Trappers speak of a "running" time with the Minks, but this probably refers to the time when the animals are hunting mates.

The mating season begins early — generally in February — and April is for the most part the month of reproduction. Five or six young are ordinarily produced at a birth, and the young remain with their mother through the summer. Litters have been found in the hollow of a log, as well as in the customary burrows.

The Mink has been frequently tamed, and is said to become with due care perfectly gentle and tractable, though liable to sudden fits of anger, when no one is safe from its teeth. Without showing special affection, it seems fond of being caressed, and may ordinarily be handled with perfect impunity.

Minks are not burrowing animals in a state of nature, but freely avail themselves of the holes of Musk-Rat and other rodents. They cannot climb a smooth surface, but ascend readily where there is roughness enough for a nail-hold. Tame Minks make excellent ratters, hunt vigorously, and soon exterminate the troublesome pests. Rats will make off on scenting them; they are so bewildered in flight that they give no battle, but yield at once; and the Mink severs the main vessels of the neck so quickly and skilfully that an observer would scarcely imagine the deed had been done.

Dr. A. K. Fisher says: "The Mink feeds on fish, crayfish, mussels, bats, and like the Weasel is indefatigable in its search for meadow mice and other marsh-loving rodents. It is very fond of Musk-Rats, and one of its most important services to man is the destroying of these pests about milldams, canals, and dikes, where their burrows undermine the embankment and cause disastrous overflows. The Mink, although semi-aquatic, sometimes travels long distances from water in search of rabbits, ducks and chickens. When it finds an unprotected poultry house, it sometimes contents itself with a single victim; but other times it kills all the inmates within reach. A single Mink has been known to kill thirty to forty ducks or chickens in one night. Fortunately such occurrences are rare and certainly will become less frequent, since the demand for Mink fur is constantly increasing."

LARGE STRIPED SKUNK

Mephitis mephitis *(Schreber)*

General Description.— A large robust-bodied animal as large as a cat, with pelage of clear black and pure white. Body thick-set; legs rather short; tail bushy; claws curved; ears short; anal musk glands exceedingly well developed; soles nearly wholly naked, partly plantigrade; color black all over, with the exception of broad white stripe from head along back and onto tail; white line down forehead to nose.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{1-1}{2-2} = 34$.

Pelage.— ADULTS: Sexes similar and no seasonal variation. Pelage composed of two types of hairs, long hard hair and short soft underfur. Color everywhere black, but with broad white band commencing at crown of head running backward, at first as one stripe, then dividing back of shoulders into two stripes along the upper side and continuing thus out along sides of tail; a narrow white stripe from middle of nose to crown; black hairs of tail white at base; tail white at tip. YOUNG: Striped like adults.

Measurements.— Sexes about the same. Length, 24 inches; tail, 8 inches; hind foot, 3 inches. Weight, 7 to 8 pounds.

Range.— Eastern Canada west and north to Keewatin.

Food.— Small mammals, birds, insects, frogs, crayfish and snakes.

Remarks.— The Striped Skunks of the genus *Mephitis* range over nearly all of North America south of Hudson Bay and from coast to coast. They are readily distinguished from the Little Spotted Skunks of the genus *Spilogale* by their large size and by the quite different color pattern, the broad white stripes of the

Photograph by H. T. Middleton

HUNTING FOR TROUBLE

An adventurous Irish terrier is making the acquaintance of two Eastern Skunks

Mephitis group being a good diagnostic character. There is a wide range of individual variation in coloration, some animals having the white stripes very broad and prominent, others being nearly all black. About 15 species and subspecies are known from the region under discussion. Many of the characters upon which the species are based are to be found only in the skull.

RELATED SPECIES

Large Striped Skunk.—*Mephitis mephitis* (Schreber). Typical animal described above. Eastern Canada.

Hudsonian Skunk.—*Mephitis hudsonica* (Richardson). Larger; tail heavy and with no white tip. Western Canada from Manitoba to British Columbia, south to Colorado, Nebraska and Minnesota.

New England Striped Skunk.—*Mephitis putida* Boitard. Size medium; tail longer than that of *Mephitis*, tip white. New England and Middle Atlantic States, south to Virginia, west to Indiana.

Florida Striped Skunk.—*Mephitis elongata* (Bangs). Florida to North Carolina and West Virginia, west on Gulf coast to the Mississippi.

Southern Striped Skunk.—*Mephitis mesomelas mesomelas* Lichtenstein. Size very small; tail short, generally all black. Mississippi Valley from southern Louisiana to Missouri, westward into Texas.

Arizona Striped Skunk.—*Mephitis estor* Merriam. Black stripe on back narrow, tail with white tip. Arizona, New Mexico and eastern California.

Western Striped Skunk, or California Skunk.—*Mephitis occidentalis occidentalis* Baird. Wide lateral stripes not extending far onto tail; hairs of tail white on basal half. California in central and southern part, and southwestern Oregon.

Puget Sound Skunk.—*Mephitis occidentalis spissigrada* (Bangs). Skull narrow; tail long. Puget Sound and coast region of Washington, and northern Oregon.

Mearns Hooded Skunk, or Northern Hooded Skunk.—*Mephitis macroura milleri* (Mearns). Size medium. A member of a subgenus *Leucomitra* that differs from the other Striped Skunks in having dorsal stripe continuous along back, not forked. A group of southern distribution, Mexico. It reaches the United States only in Southern Arizona.

Photograph by S. A. Lottridge

STRIPED SKUNK

This pretty animal appeals to the sense of sight, if not of smell. Its handsome fur is a valuable commercial commodity

The Striped Skunk is among the handsomest animals of the fields, but being a wanderer of the night, he is not so frequently seen as the Squirrel or Woodchuck. However he is not strictly a nocturnal animal and may be found wandering about the fields in broad daylight, by the unwary.

The Skunk, like many other animals, is known in different localities by special names, such as "wood-pussy," "essence-peddler," and "polecat." Unlike most other animals, it has increased rather than decreased in numbers in the rural districts, for civilization has diminished its natural enemies and increased the food resources.

It is perfectly fearless of man and other animals, and if allowed to go its way undisturbed, will pass close to you with a genteel and dignified indifference, attending strictly to its own business; but, if interfered with or followed closely or suddenly alarmed, it will prepare for self protection, and woe to the man or animal insisting on disturbing it too much. Such implicit confidence has the animal in its own ability to defend itself that it wanders about as boldly as though lord of all it surveys.

That which particularly distinguishes the Skunk from other animals is its means of defense, which is a musky secretion having a most powerful and disagreeable odor. In addition to its terrible odor, the fluid is so intensely acid that it burns the skin like fire. In extreme cases such a discharge has been known to produce blindness. The fluid is yellow in color, somewhat phosphorescent, and resembles musk in its extraordinary volatility. The discharge at any one time is scarcely three drops, yet this small quantity will perfume the air for a half mile or more in every direction. The fluid or secretion employed by the Skunk in protecting himself is stored in two glands located under the tail, and from the glands, and the apparatus is ejected a short distance from the end of the digestive tract when the essence is to be delivered. This arrangement easily explains the absence of the odor on the Skunk immediately after using its weapon of defense.

Skunk fur has always been in demand, and for several years past the price has greatly increased. The black fur is the more valuable, but the coloring of fur is now so largely practiced that it makes little difference how much white there is, for the skins all go through the dye to make them uniform in color. After dyeing, cutting, and making, few suspect that the fashionable "Alaska Sable" furs in our city shop

STRIPED SKUNK

The Skunk, like the Porcupine, is fearless of other animals and man, for it knows that its natural weapons will cause it to be left undisturbed

may be ejected by muscular contraction to the distance of about ten feet. The contents of the glands are discharged, probably one or both at a time, as the occasion demands, in the form of a very fine spray. When the Skunk is facing you there is no danger that he will discharge his artillery. It is only when he turns tail toward the enemy that there need be alarm. Many believe that the Skunk scatters the essence with his tail, but this is entirely incorrect, for the Skunk is a very cleanly animal, and during the discharge the tail is arched high above the back to keep it undefiled. If he were to wet his tail with the essence, he would attract many enemies in the vicinity, and without doubt it is a matter of both prudence and comfort for him to remain free from the stench. The Skunk is provided with a special apparatus for discharging the fluid, which is connected with the ducts leading

windows come from little bicolored animals, called "wood-pussies" by the country folk.

The home of the Skunk is usually in a burrow in the forest which it digs with its powerful claws, but it may also take possession of a deserted Woodchuck's burrow, a cave, hollow log, or a stone wall. The den contains a large bed of grass and leaves, and here the young are born in the spring. When the young are about a quarter grown, they follow the mother on night excursions in search of food, and while moving from place to place they go in single file, forming a line fifteen to twenty feet in length. The young may be captured in the following manner: The would-be captor takes his place behind the line, and noiselessly approaches the rear Skunk, lifting it quickly from the ground by the tail. This may be nervous work for the novice, but is entirely safe, for when a Skunk is thus lifted

from the ground the power of spraying the essence is apparently lost. It takes a steady nerve to approach an old Skunk and lift it by the tail, and although I have heard of several instances, I have but once actually seen it accomplished.

If the young are captured while small and are constantly handled and petted, they show a considerable degree of affection, and at times are very playful. Dr. C. Hart Merriam tells the following story about one of his Skunks, "Meph": "His nest was in a box at the foot of

Photograph by W. L. Finley

A NERVE TESTER

Hold a Skunk by the tail and he is harmless — that is, if you get there quickly enough

the stairs, and before he grew strong enough to climb out by himself, he would, whenever he heard me coming, stand on his hind legs with his paws resting on the edge of the box, and beg to be carried upstairs. If I passed by without appearing to notice him, he invariably became much enraged and chippered away at a great rate, stamping meanwhile most vigorously. During the evening he occasionally assumed a playful mood and would steal softly to my chair, and, standing erect, would claw at my pants once or twice and then scamper off as fast as his little legs could carry him, evidently anxious to have me give chase. If I refused to follow, he was soon back, ready to try some new scheme to attract my attention."

Skunks have no way of expressing their joy, like the cat or dog, for the young and old alike are nearly voiceless, with the exception of an occasional little squealing or grunting noise.

The Skunk lives upon animal food, but in summer it is largely made up of insects, in particular grasshoppers. The number of insects a single one will destroy is beyond comprehension. The Skunk is one of the most efficient aids of the agriculturist, yet, when he takes up his abode under the barn, there is sure to be trouble among the fowls unless they are well housed, the greatest loss being among chickens. The mother hen may have a dozen little ones tucked away at night under protecting wings, and before morning a skillful paw may remove half the number, or more, leaving only the slightest trace of their unhappy end. The location of the mother hen and her remaining chickens must be changed, for Mr. Skunk will continue his nightly visits until the whole family is devoured. Other domestic fowls suffer in much the same way from such depredations. The ground-nesting birds probably pay a heavy tribute, both in eggs and in young, to this robber of the poultry yard. The few chickens he may destroy (not one Skunk in 500 ever tastes chicken) is small compensation for the destruction of field mice, beetles, and various forms of vermin, yet he is killed by the average farmer, whose prejudice is only exceeded by his ignorance of this most beneficial animal.

Again, the Skunk is particularly valuable in the hop regions, where he hunts the large grubs so destructive to the hop-roots. On a spring morning as you pass through the hop-yard you may notice numerous holes about the hop-hills. These indicate the industry of the nocturnal visitor.

There is a general belief that the Skunk hibernates during the winter. It does hibernate, but the period of hibernation is not as continuous or deep as in the case of many animals. The period of rest is broken several times during the winter, whenever the weather becomes mild for two or three days at a time. This season of inactivity becomes more pronounced the farther north we go, but the *degree* of it corresponds with the severity of the weather.

S. A. Lottridge.

LITTLE SPOTTED SKUNK

Spilogale putorius (*Linnaeus*)

General Description.— A strikingly marked black and white carnivore rather smaller than a small cat. Form moderately thick-set; head broadly triangular; ears small; tail long, bushy, with very long drooping hairs; anal musk gland well developed; naked pads at base of toes four in number on both fore and hind feet; coloration strongly contrasting black and white; hair everywhere long, the outer hairs hard and glistening, with an underfur of short soft hairs.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{1-1}{2-2} = 34$.

Pelage— Adults: Sexes similar. No seasonal variation. Color above and below, black with clear white markings distributed as follows: four white stripes along the dorsal region from the ear to about middle of back, then continuing as irregular spots or bands down almost to base of tail; a white stripe commencing just behind fore leg and extending backward parallel with stripe above, and finally curving up towards the back, just beyond the end of the white stripe above it; white spot upon the hip, a white spot on forehead between eyes, end of tail white. This pattern remains fairly constant for individuals, but there is some variation in the width and continuity of the white stripes. Young: Spotted and marked like adults.

Measurements.— Length, 18 to 22 inches; tail, 7 to 8 inches; hind foot, 2 inches. Sexes about the same.

Range.— Virginia to Georgia, westward to eastern Arkansas and Missouri, north to western Kentucky, southern Illinois and southern Indiana.

Food.— Small mammals, birds and their eggs, and some insects.

Remarks.— The Spotted Skunk and its relatives of the genus *Spilogale* are the smallest of the North American Skunks. In some parts of the country, more particularly in the southwest, the skunks of this group have earned for themselves the name of "Hydrophobia Skunks" because of the idea that their bite carries hydrophobia. Considerable individual variation in the extent of the white markings and the number of different species and subspecies described, together combine to confuse the layman who would try to distinguish between the different kinds of this small skunk. About 13 different forms are listed north of the Rio Grande. A few of the more widely different varieties are given.

Related Species

Little Spotted Skunk.— *Spilogale putorius* (Linnaeus). The typical animal. See description above. Georgia, western South Carolina, Alabama, Mississippi northward along the Alleghenies to northern Virginia, westward at least to Illinois.

Florida Spotted Skunk.— *Spilogale ambarvalis* Bangs. Size small; white markings prominent; tail short. Eastern portion of peninsular Florida.

Rafinesque's Spotted Skunk, or Prairie Spotted Skunk.— *Spilogale interrupta* (Rafinesque). White stripes more broken and with less white; tail entirely black or with only a few white hairs. Iowa, southern Minnesota, Nebraska, Kansas, Missouri and Oklahoma south to east central Texas.

Texas Spotted Skunk.— *Spilogale indianola* Merriam. Similar to Prairie Spotted Skunk, but tail white for about ⅓ of its length. Coast region of Texas.

Arizona Spotted Skunk.— *Spilogale arizonae* (Mearns). Principal characters of difference to be found in the skull. Central and southern Arizona, western New Mexico.

Rocky Mountain Spotted Skunk.— *Spilogale tenuis* Howell. Terminal third of tail white; cranial differences separating it from other members of the genus. Rocky Mountains in Colorado and New Mexico.

Western Spotted Skunk— *Spilogale phenax* Merriam. White markings on body very extensive, much white on tail. California.

Mearns's Spotted Skunk.— *Spilogale ambigua* Mearns. White spots small; size small; body slender. Central Arizona south.

Desert Spotted Skunk.— *Spilogale gracilis gracilis* Merriam. Similar to Western and Mearns's, but slender. Northern Arizona and southeastern California.

Although its coat is differently marked from that of its striped cousin, the Spotted Skunk is not essentially different in habits. It is the same unconcerned animal going serenely on its way, in the knowledge that it will be given a wide berth. This variety also is widely distributed in America, but is much more common in the West than in the East. It is a graceful, beautifully marked animal, with spots alternating with stripes. However, in the furrier's hands its fur is usually dyed a uniform black, and for this reason its natural markings are unfamiliar.

Some species of the Spotted Skunk have been called Hydrophobia Skunk, from the widely prevalent idea that their bite produced madness. This topic has been debated at length, but as yet no very definite conclusions have been reached as to whether man and some of the higher animals develop hydrophobia when bitten by the Skunk. This may or may not be true, all de-

pending upon circumstances. The bite of the Skunk is no more to be feared than that of other animals such as the fox or dog, but it should be remembered that blood-poisoning may follow, and it may not be due to rabies.

It is a well established fact that rabies has appeared among Skunks in various parts of the country, and that men and animals bitten have developed hydrophobia and died. It has been stated that this is a distinct disease among Skunks and is known as mephitic rabies. Others as stoutly maintain that it is not a specific disease of Skunks, but simply canine madness developed in the Skunks by a mad dog or fox. An interesting discussion of the subject may be found in the *American Journal of Science and Art,* May, 1874, and in the *New York Medical Record,* March 13, 1875.

Regarding the economic value of this animal, aside from the value of its fur, Dr. A. K. Fisher says: "The Skunk is a 'chicken thief' which renders important service by destroying immense numbers of mice, white grubs, grasshoppers, crickets, hornets and other noxious forms. Although it prefers this kind of food, like the Opossum, it will eat almost any animal matter and also at times certain wild fruits and berries. It is said to be fond also of eggs and young chickens, but the writer has known a mother Skunk to make her nest and rear her young in the inner walls of a chicken yard, and neither egg nor fowl was molested."

Photograph by S. A. Lottridge

THREE OF A KIND

A happy family of little Skunks, caught napping upon a log

BADGER

Taxidea taxus *(Schreber)*

General Description.— Form thick-set and about size of a spaniel. Body muscular; tail short; legs short; front feet powerful with long claws and adapted for digging; ears short; head broadly triangular; nose sharp; hair long and falling from sides like a mantle; general color silvery gray with white markings on face.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{1-1}{2-2}=34$.

Pelage.— ADULTS: Sexes similar, seasonal variation slight. General color above, silvery gray, the hairs being yellowish white at base, then blackish with white tip; neck, crown and muzzle brown; cheeks, chin and stripe from nose over forehead to shoulders white; underparts yellowish-white; bar on each cheek, back part of ear and feet dull black; tail yellowish-brown. YOUNG: Similar to adults.

Measurements.— Length, 28 inches; tail, 5 inches; hind foot, 4 inches. Weight, 15 pounds. Sexes similar in size.

Range.— Northern Indiana west to Sierra Nevada Mountains, south to Kansas and New Mexico, north to Saskatchewan, latitude 55°.

Food.— Small mammals and occasionally birds, but principally ground squirrels, gophers, prairie dogs and mice.

Remarks.— The Badger may be easily distinguished from all other members of the family *Mustelidae* by its large size, grayish color and peculiar depressed appearance, due partly to structural arrangement, and partly to the long mantle of hair falling from his sides, which gives him a flattened out appearance. It is a very powerfully built adaptation of nature for digging. But one species of Badger is known, although this species has been subdivided again into four subspecies, only three of which are found in the United States.

Related Forms

Common Badger.— *Taxidea taxus taxus.* (Schreber). Typical animal as described above. Central North America from the Great Lakes to the western slopes of the Rockies, from Texas as far north as latitude 55°.

Western Badger.— *Taxidea taxus neglecta* (Mearns). Smaller, tail longer, color deeper and richer. California.

Berlandier's Badger.— *Taxidea taxus berlandieri* (Baird). White line on back extending to tail; general color buffy; other markings heavier. Texas, New Mexico, Arizona.

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BADGER AT BAY

The Badger is inoffensive enough until cornered, when it will fight "like a stack of Wild Cats"

The Badger has been called a timid animal. It is, rather, a prudent one for it avoids rather than confronts danger. It prefers the safety of its underground retreats to the chance of unequal combat. Certainly, no lack of courage and physical endurance is seen when the creature, captured or cut off from its retreat, is brought to bay. Its pluck is then as conspicuous as its really formidable strength. Because of this well-known fact the cruel sport of "Badger-baiting" was formerly indulged in, in the West; and if the animal were given a barrel or similar retreat in which it was secure from attack in the rear, it proved more than a match for any dog. The fighting qualities of the Badger, and the stubborn resistance it offers at whatever odds, have supplied our language with a word of peculiar significance: to "badger" is to harass and worry.

The stout, thick-set, and depressed shape of the animal is greatly in its favor, combining with the long loose hair to prevent a dog from reaching vulnerable parts, and to embarrass it in attempting to take hold; the snap of the jaws inflicts a serious wound; and, finally, it possesses extreme tenacity of life.

Dr. J. S. Newberry gives the following evidence of the Badger's powers of self-defence:

"In traversing the arid surfaces of the sage plains of eastern California, Utah and Oregon, there is, perhaps, no one thing which the traveler may be more sure of seeing every day of his journey than the burrow of a Badger; and, after cursing the country, and the folly which led him to cross these barren, hot and dusty surfaces, there is nothing he will more certainly do, whether on foot or mounted, than tumble into one of these same Badger holes. And yet the chances are more than equal that he never sees a living Badger on which to revenge himself; for the Badger is a shy and timid animal, and the country he inhabits is so open, it rarely happens that he is surprised at a distance from his burrow. During our march of several hundred miles through the country inhabited by the Badger this did occur, however, on one or two occasions, and gave rise to some ludicrous scenes. The Badger, though far from formidable, is too well provided with teeth to be handled without gloves; and knowing that his only safety when attacked is in plunging to the bottom of his burrow, his pig-headed pertinacity in endeavoring to reach it is such, that an unarmed man finds it difficult to stop him.

"Mr. Anderson, who gave me most efficient aid in collecting, came one day suddenly upon a Badger at some distance from his hole; of course, he made for it with all possible speed, which, it should be said, is not so great but that a man could easily overtake one. Mr. Anderson at first endeavored to trample him under his horses's feet, but, though he ran over him several times, the Badger avoided the hoofs and received no injury. As we had not obtained a specimen, he was particularly anxious to secure this one, so he drove his horse before him, and brought him to bay. He then jumped off, hoping by means of kicks and his sheath knife, to dispatch him; but the Badger, instead of retreating, came at him open-mouthed, and with such a show of ferocity that he was fain to let him pass, trusting to find a club to kill him; but in this region clubs do not 'grow on every bush,' for most of the bushes are sage bushes, and before he found any sort of stick the Badger had reached his hole."

Sir John Richardson narrates an incident which further illustrates the prowess of this stubborn, sullen customer. "The strength of its forefeet and claws is so great," says he, "that one which had insinuated only its head and shoulders into a hole, resisted the utmost endeavors of two stout young men who endeavored to drag it out by the hind legs and tail, until one of them fired the contents of his fowling-piece into its body." This is quite a match for the stories told of the Armadillo itself. "Early in the spring, however," the author continues, "when they first begin to stir abroad, they may easily be caught by pouring water into their holes; for the ground being frozen at that period, the water does not escape through the sand, but soon fills the hole, and its tenant is obliged to come out."

The author of the "Complete American Trapper" also refers to this method of taking Badgers, and adds others: "Although his general appearance will not indicate it, he is a sly and cunning animal and not easily captured in a trap of any kind. He has been known to set at defiance all the traps that were set for him, and to devour the baits without suffering from his audacity. He will sometimes overturn a trap and spring it from the under side before attempting to remove the bait. Although not quite as crafty as the Fox, it is necessary to use much of the same caution in trapping the Badger, as a bare trap seldom wins more than a look of contempt from the wary animal."

"The Badger," adds Coues, "above all other animals is notable for its flatness; even when runnings it looks broad and flat, and the belly seems to sweep the ground during its rather low, heavy, and awkward progress. Seen when crouching in fancied security or hoping to escape observation (and it will sometimes remain long motionless in this posture, permitting near approach), the animal might easily be mistaken for a stone or clod of earth; the very hairs lie flat, as if parted in the middle, and form a fringe along either side, projecting like the shell of a turtle or the eaves of a house."

The ordinary Badger may be found from British North America, from latitude 55°, down through the greater portion of the United States.

In habits it closely resembles the European species, being strictly nocturnal, and living in burrows constructed by itself. In the colder portion of its habitat it hibernates. Although but very seldom seen, these animals live in countless numbers in the region of the Upper Missouri river and its tributaries; tracts of sandy soil being so full of their burrows as to render traveling on horseback dangerous. These Badger holes can be distinguished from those of the Prairie Dog by their larger size and the absence of a circular mound of earth at their entrance; though many such holes are merely burrows of the Prairie Dog, which have been enlarged by the Badger in order to capture the original owner.

Its chief food is rodents and other small animals — even insects and snails — while it is also partial to birds' eggs and to bees nests with their honey and larvae.

Little seems to be known as to the breeding habits of the Badger, but three or four young is the usual number in a litter. In British North America the period of hibernation lasts from October till April, and the animals come forth after their long fast in good condition.

"Badgers are valuable in destroying ground squirrels, gophers and other burrowing animals, as well as various kinds of insects," says Dr. A. K. Fisher. "They are extensive diggers, and seem to have little trouble in securing their victims. For their valuable service, full protection should be given them, especially in irrigation sections where they sometimes dig into dikes in pursuit of rodents which in the role of dike-borers cause so much trouble."

CANADA OTTER

Lutra canadensis (*Schreber*)

General Description.— Very large for one of the *Mustelidae*. Body long; legs short; toes webbed; soles of feet hairy; tail long and rounded, thick at base and tapering; head broad and flattened; nose short; general color brownish; dense underfur. A very strongly muscled, lithe and active animal.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{3-3}$; Molars, $\frac{1-1}{2-2}$ =36.

Pelage.— Sexes similar. Young very much like adults. Seasonal variation slight. Color in general, dark rich ochraceous brown becoming somewhat paler and grayer below; lips, cheeks, chin and throat pale brownish gray to grayish-white. The long outer hairs are hard and glossy; the underfur is dense, short and soft.

Measurements.— Sexes nearly equal. Length, 40 inches; tail, 12½ inches; hind foot, 4 inches. Weight, 20 pounds.

Range.— Greater part of the United States and Canada except on extreme southeastern and northwestern coast of the United States.

Food.— Largely fish, with a few small mammals and birds.

Remarks.— The Otter is one of the most aquatic of the group to which he belongs, being exceeded in this respect only by the Sea Otter. The long well-muscled body, the webbed feet and the long tail enable it to pursue fish in their own medium. The Otters have been separated into some seven species and subspecies known north of the Rio Grande. The differences that separate them are mainly in color, size and cranial characters.

Related Species

Canada Otter.— *Lutra canadensis canadensis* (Schreber). Typical animal of the above description. North America from Alaska to Hudson Bay and eastern Canada, south to Washington, thence south to Texas, and east to the Atlantic Coast, north of Florida.

Southern Otter— *Lutra canadensis lataxina* (F. Cuvier). Smaller. North Carolina to Louisiana, south to Florida.

Florida Otter.— *Lutra canadensis vaga* (Bangs). Larger and redder. Florida.

Sonoran Otter.— *Lutra canadensis sonora* (Rhoads). Large and yellowish. Arizona, Colorado, Utah and New Mexico.

Pacific Otter.— *Lutra canadensis pacifica* (Rhoads). Color paler. California north to British Columbia.

Newfoundland Otter.— *Lutra degener* Bangs. Size small. Newfoundland.

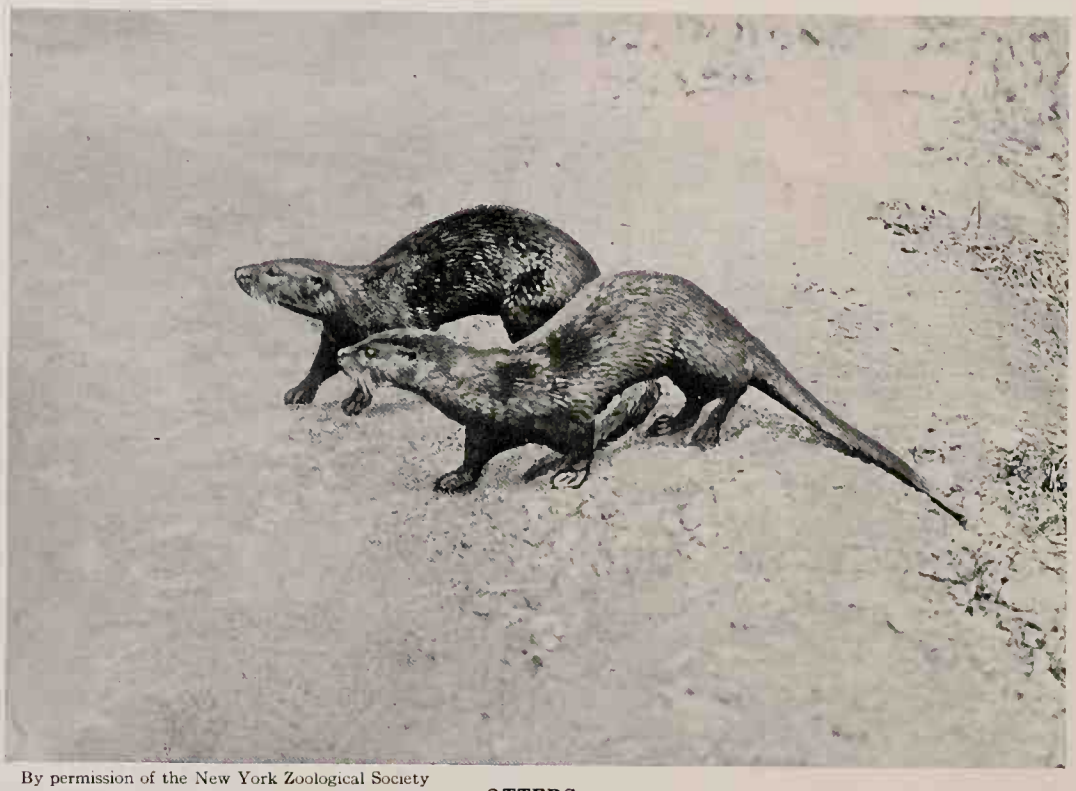
Queen Charlotte Islands Otter.— *Lutra periclyzomae* Elliot. Size large. Queen Charlotte Islands.

The Otter is an aquatic animal which swims and dives with great readiness, and with peculiar ease and elegance of movements; and although its action on land is far from awkward and difficult, yet it is certainly in the water that the beautiful adaptation of its structure to its habits is most strikingly exhibited. It swims in nearly a horizontal position, and dives instantaneously after the fish that may glide beneath it, or pursues it under water, changing its course as the fish darts in various directions to escape from it, and, when the prey is secured, brings it on shore to its retreat to feed. As the Otter lives exclusively on fish, when it can procure them, it frequents lakes, rivers, smaller streams, ponds, and not unfrequently descends to the sea; and the havoc which it makes among the finny inhabitants is almost incredible. In feeding, it holds the fish between its fore-paws, eating first the head.

Otters are generally found either in pairs or in family parties of five or six. Their homes

are made in or near the banks of a river or lake, the hollows beneath the roots of trees growing on the margin being special favorites, while in hilly districts the clefts between rocks are selected, and where the soil is of an alluvial nature deep burrows, with several entrances, one of which usually opens beneath the water, are excavated in the banks.

Otters apparently never hibernate, and in consequence must be hard pressed to supply themselves with food during the winter in the colder portions of their habitat. At such times they may make occasional raids on the farmyards.



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OTTERS

Otters are too short of limb to move easily on land, but are wonderfully agile and graceful in water. They are also fond of sliding down mud banks

Water-fowl are probably also attacked at such periods, while eggs are always acceptable. In addition to fish, Otters are fond of frogs and shell-fish.

The number of young in a litter is usually two, although there may be either one or three. They are born about the middle of April, and during the summer and autumn the young stay with their mother.

The fur of the Otter, says Coues, is of great beauty, very thick, close, short and shining. The longer hairs are stout and glistening; the very copious under-fur is lanuginous and lustreless. The sheen is only visible in its perfection when the pelt is viewed with the lay of the hairs; from the other direction the color is plain. The roots of the hairs, even on the darkest part of the pelage, are light brown, or dingy white, but the fur is so close that this does not appreciably affect the rich brown tone of the surface.

According to Richardson, one of the earliest authors giving accounts of the species with precision, "The Canada Otter resembles the European species in its habits and food. In the winter season, it frequents rapids and falls, to have the advantage of open water; and when its usual haunts are frozen over, it will travel to a great distance through the snow, in search of a rapid that has resisted the severity of the weather. If seen, and pursued by hunters on these journeys, it will throw itself forward on its belly, and slide through the snow for several yards, leaving a deep furrow behind it. This movement is repeated with so much rapidity, that even a swift runner on snow-shoes has much trouble in overtaking it. It also doubles on its track with much cunning, and dives under the snow to elude its

pursuers. When closely pressed, it will turn and defend itself with great obstinacy."

The sliding of the Otter seems to be a favorite amusement of this creature. Godman speaks of the diversion in the following terms: "Their favorite sport is sliding, and for this purpose in winter the highest ridge of snow is selected, to the top of which the Otters scramble, where, lying on the belly with the fore-feet bent backwards, they give themselves an impulse with their hind legs and swiftly glide head-foremost down the declivity, sometimes for the distance of twenty yards. This sport they continue apparently with the keenest enjoyment until fatigue or hunger induces them to desist."

Statements of similar import are made by various writers, and accord with Audubon's observations: "The Otters ascend the bank at a place suitable for their diversion, and sometimes where it is very steep, so that they are obliged to make an effort to gain the top; they slide down in rapid succession where there are many at a sliding place. On one occasion we were resting on the bank of Canoe Creek, a small stream near Henderson, which empties into the Ohio, when a pair of Otters made their appearance, and not observing our proximity, began to enjoy their sliding pastime. They glided down the soap-like muddy surface of the slide with the rapidity of an arrow from a bow, and we counted each one making twenty-two slides before we disturbed their sportive occupation."

The general intelligence of the Otter is of a high order, and his docility is such that he may not only be thoroughly tamed, but taught to work for his master. Audubon speaks of four American Otters which were tamed so completely that they would answer a whistle like dogs, and became very agreeable as well as useful pets.

SEA OTTER

Latax lutris (*Linnaeus*)

General Description.— Size very large, general appearance much as Canadian Otter. Body long; fore-feet small; hind feet large, fully webbed, flapper like, haired on both surfaces; tail flattened, smooth, about one quarter length of body; claws of moderate length; ears very small and low on side of head; skin very loose on body; fifth toe longest, others diminishing to the first; molar teeth large and smooth on crown; color dark, frosted with white tipped hairs.

Dental Formula.— Incisors, $\frac{3-3}{2-2}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{1-1}{2-2}$=32.

Pelage.— Sexes similar. Seasonal variation slight. Color black, with white tips to the longer hairs, giving frosted appearance; head and neck grayish-white or yellowish-white; an exceedingly dense underfur is present, formed of shorter and softer hairs, and through this coat a much less dense outer coat penetrates, the hairs hard and lustrous. In summer the long, white-tipped hairs are more numerous, producing a grizzled appearance.

Measurements.— Length, 48 inches; tail, 11 inches; hind foot, 6 inches long and 4 inches wide.

Range.— North Pacific south to California in kelp beds among rocky islands and along the coast. Now a very rare animal, and nearly extinct on American shores.

Food.— Fish, mussels, clams and molluscs.

Remarks.— The Sea Otter is the most highly specialized member of the *Mustelidae*, being purely aquatic in its habit and taking all its food in the water. Although so highly developed, it has yet retained many of its more primitive characters, and is readily seen to be related to its kindred ashore. Specimens of the Sea Otter are very rare in collections, and but little is known of its life history. One species divided into two subspecies is known.

Related Forms

Sea Otter.— *Latax lutris lutris* (Linnaeus). Typical animal as described above. North Pacific south to California.

Southern Sea Otter.— *Latax lutris nereis* Merriam. Much like the typical form. Waters off California coast.

The Sea Otter is an inhabitant of both coasts of the North Pacific; its chief haunts on the American side being Alaska, the Aleutian Islands, the neighborhood of Sitka Island on the west coast of Canada, and Vancouver Island; its southern limits being the shores of Oregon. On the Asiatic side it occurs in Kamschatka, but apparently more rarely than on the eastern shores of the Pacific.

When the Russian traders first opened up the Aleutian Islands, they found the natives commonly wearing cloaks made of the fur of the

Sea Otter, which they were at first willing to sell for a mere trifle, esteeming these skins much less than they did those of the fur-seals. Again, when the Prybiloff Islands, situated in Behring Sea to the eastward of the Aleutians, were first discovered, upwards of five thousand skins of this species were taken in the first season, with the result that in six years these animals had completely disappeared from the islands. Nearly the same story is told in all the haunts of the Sea Otter, which has now become a very rare animal indeed, and stands in sore need of protection if it is to escape total extermination.

Mr. H. W. Elliott, states that "over two-thirds of all the Sea Otters taken in Alaska are secured in two small areas of water, little rocky islets and reefs around the islands of Saanach and Chernobours, which proves that these animals, in spite of the incessant hunting all the year round on this ground, seem to have some particular preference for it, to the practical exclusion of nearly all the rest of the territory. This may be due to its better adaptation as a breeding-ground." A similar preference is also shown for a small area in the neighborhood of Gray's Harbor, over the whole of the remainder of the coast of Washington and Oregon.

The female Sea Otter produces but a single young one at a birth, so that the increase of the species can be, at best, but slow. The young may apparently be born at any season of the year, and do not attain maturity till four or five years old. Writing of the general habits of the species, Mr. Elliot observes that the "mother sleeps in the water on her back, with her young clasped between her fore-paws. The pup cannot live without its mother, though frequent attempts have been made by the natives to raise them, as they often capture them alive, but, like some other species of wild animals, it seems to be so deeply imbued with fear of man that it invariably dies from self-imposed starvation."

The remarkable difference in the structure of the cheek-teeth of the Sea Otter from those of the true Otter clearly indicates that there must be an equally marked difference in the food of the two; and the rounded prominences on the crowns of those of the present species would further suggest that they were adapted for pounding and crushing hard substances. As a matter of fact, Mr. Elliot tells us that the food of the Sea Otters "is almost entirely composed of clams, mussels, and sea-urchins, of which they are very fond, and which they break by striking the shells together, held in each fore-paw, sucking out the contents as they are fractured by these efforts; they also undoubtedly eat crabs, and the juicy tender fronds of kelp or sea-weed and fish."

SEA OTTER

The fur of this animal is so valuable that it is in danger of extinction from over-hunting

The flesh of the Sea Otter is very unpalatable, highly charged with a rank smell and flavor.

Old hunters assert that they have watched the Sea Otter for half an hour at a time as it lay upon its back in the water and tossed a piece of sea-weed up in the air from paw to paw, apparently taking great delight in catching it before it could fall into the water. It will also play with its young for hours.

The quick hearing and acute smell possessed by the Sea Otter are not equaled by any other creatures in the territory. They will take alarm and leave from the effects of a small fire four or five miles to the windward of them; and the

footstep of man must be washed by many tides before its trace ceases to alarm the animal, and drive it from landing.

Sea Otters are not polygamous. A pair will usually mate for life. Neither are they social animals. Only one at a time is usually met with at sea, unless it is a mother with her young one.

The pelage is extremely valuable. In the days when the animal was plentiful, skins brought from $100 to $500 apiece. Now that it is fast disappearing, skins are sold for as high as $1500 and even more. For this reason, the Sea Otter is relentlessly hunted, although usually a hazardous business, on account of the wild country it inhabits. One of the first official steps to protect the Sea Otter was the setting aside of a preserve on Afognak Island, on the southern coast of Alaska, in 1892. This was placed under the jurisdiction of the Federal Bureau of Fisheries. Without such protection, it would be doomed to extermination, and this despite the fact that it is one of the shyest and keenest of animals.

From a drawing by Henry Thurston

SEA OTTER

The Sea Otter is an inhabitant of both coasts of the North Pacific: its southern limit on the American side being the coast of Oregon. But it is now extremely rare

By permission of the New York Zoological Society

COUGAR

Known also as the Puma, Panther, Mountain Lion and Catamount, this beast was formerly numerous and widely scattered throughout temperate North America

THE CAT FAMILY

(Felidæ)

THE family of Cats is one of the most sharply defined of all the Carnivores or flesh-eating animals. Whether seen in its most familiar form, the House Cat, or in the larger members from the jungle, such as the Lion or Tiger, the strong family traits can instantly be noted. These are not only found in the peculiar shape of the skull and the facial traits, but also in certain, characteristic habits, such as washing the face, "sharpening" the claws, and contracting the pupils of the eyes.

The Cats have long, sharp retractile claws. The feet are digitigrade, with five toes on each fore foot, and four on each hind foot. The soles are hairy, and pads naked. The tongue is covered with sharp, horny, backwardly directed papillæ. The powerful jaw is armed with a large shearing tooth, or carnassial. The skull is short and broad, with a very short face. The clavicles do not articulate, or hinge, with the scapulæ or sternum.

In America there are four or five typical large members of this family living in a wild state.

COUGAR

Felis couguar *Kerr*

Other Names.— Panther, Puma, Mountain Lion, Catamount.

General Description.— A very large, cat-like animal with a long tail. Body long and lithe; legs moderately long; tail long and round, more than half the length of head and body; claws long, sharp, curved; soles haired, pads naked; general color pale tawny brown above, dirty white below; tail tipped with black; ears prominent, without tufts of long hair. Young spotted.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{1-1}{1-1} = 30$.

Pelage.— ADULTS: No difference between the sexes and color in winter much the same as in summer. Color variable; upper parts from yellowish to reddish brown, darkest along the middle of back; beneath dirty white; black patch at base of whiskers; lips and chin white; back of ear black; tip of tail dusky; hair everywhere rather close, thick and soft to the touch; whiskers prominent. YOUNG: Spotted in the first coat, the ground color being tan, the spots dark brown.

Measurements.— Length, 7 feet; tail, 30 inches; hind foot, 10 inches. Sexes about equal, the male about a foot longer than female. Weight of male, 200 pounds.

Range.— Formerly throughout eastern North America from about the Canadian line south to the Gulf, but now extinct in the easternmost part of this region.

Food.— Mammals and birds; especially destructive to deer, elk and domestic stock, colts in particular.

Remarks.— This beautiful animal while formerly known all over eastern North America has been driven out by civilization and the disappearance of its prey until now it is nowhere found in anything like its original numbers until the western part of its range is reached. Cougars are found throughout western North America and on the Pacific Coast as well, but this animal differs enough from the eastern form to be given another name. The Cougar, like the Grizzly Bear, has received various treatments at the hands of the classifiers, but for the purpose of this book, it is best to consider the group north of the Rio Grande as being composed of 5 species and subspecies.

RELATED SPECIES

Eastern Cougar.— *Felis couguar* Kerr. Typical animal as described above. Eastern North America from Canada south to the Gulf.

Southern Cougar.— *Felis coryi* Bangs. Legs long; feet small; color ferruginous brown. Florida.

Oregon Cougar.— *Felis oregonensis oregonensis* Rafinesque. Size large. Northwest coast east to Rocky Mountains.

Rocky Mountain Cougar.— *Felis oregonensis hippolestes* (Merriam). Above, pale fulvous brown, darkest on the back; tip of tail black; face to eyes grayish-brown; under side soiled white; under side of tail grayish-white. Rocky Mountains.

Brown Cougar.— *Felis azteca browni* Merriam. Paler and grayer than eastern Cougar. Size probably smaller. Southern California and Arizona.

Next to the Jaguar, the Cougar is the largest of the American Cats. In color it is a tawny brown, becoming lighter on the lower surface, and without any spots at all. But the odd thing is that its young are marked all over with large blotches of blackish brown, while their tails are ringed with black like that of the Tiger. And these markings do not disappear until the animal is more than six months old.

The Cougar is found in western parts of the American continent, from British Columbia in the north to Patagonia in the south, and it is even said to have been seen in Tierra del Fuego. Being so widely distributed it rejoices in several names. In the Northwest they call it the "Mountain Lion," in the Southwest the "Cougar;" the Mexicans and South Americans know it by the sobriquet "Puma;" to the naturalist it is *Felis* several things; J. Fenimore Cooper names it the "Varmint," and in the Gulf States it answers to the chill-producing name of "Panther," while the early settlers in the East called it the "Catamount," and the "Painter;" but whatever the name, and whatever the locality, it is one and the same Cat.

Mr. Edward Ferguson thus describes him: "A massive broad flat head, malignant yellow eyes, muscles and sinews like coiled springs of steel wire, the hate of a demon, a cunning that surpasseth understanding, viciousness personified, all wrapped up in a tawny reddish coat ending in a long, cylindrical, nervous tail; this is the American Mountain Lion. This big Cat, one of the largest of the American varieties, averages forty inches from nose to root of tail, and the latter is more than half the length of the body. He is sleek and thin of flank, graceful and willowy of movement, and anything but pretty to the eye. No mane adorns his shoulders, no stripes relieve his coat, his belly fur is usually a dirty white, his ears are large and round, and his only ornament is a little tuft of hair at the end of his tail.

"His range is greater than that of any other member of the Cat family and extends for over a hundred degrees of latitude, from Northern Canada to the Argentine, and before civilization drove them back they were found from the Atlantic to the Pacific in considerable numbers. Hardy and tenacious, capable of adapting themselves to all conditions of climate, good foragers and clever thieves, they have not entirely given way in the West Virginia and Kentucky mountains and in the woods of Maine. In the Rockies,

Photograph by Daniel J. Singer

COUGAR

Quick, alert, and agile in its actions, this big Cat is powerful enough to be dangerous to man — but as a matter of fact, it is slinking and cowardly

they are entirely at home, their haunts are always inaccessible, and it is doubtful if they will ever be exterminated."

Calves, colts, sheep, dogs, chickens, in fact any kind of flesh is the Cougar's diet; it shows a pronounced preference for lamb but when famished will not hesitate to attack a steer. Its midnight raids are carefully planned, its descent on the prey is quick, sure and deadly, it takes no chances and when opportunity offers will kill more than it can possibly consume, wantonly satisfying its lust for blood. These great Cats live in communities, each group ranging over a certain zone, usually along both sides of a valley for many miles of its length. The group consists of one male and from five to ten females, each with her own lair.

The female is nearly as large as the male and is his counterpart in appearance. She picks a permanent abode, a pile of loose rock, under and through which she can crawl. Here with but one possible entrance to guard, she rears her young, and this guardianship is her most serious business in life, for when the litter has been born the male will haunt the neighborhood watching for a chance to kill them.

The extent to which a female Cougar will go in defence of her young is illustrated by a story that Mr. Ferguson tells of a fight between this animal and a Bear which stumbled upon her den. "The Bear peacefully ambled along evidently unconscious of the Lion's presence when, as he approached the pile of rock where her kittens were hidden, the Lion suddenly appeared. She might just as well have remained hidden, and if she had the Bear would, without doubt, have gone on his way in peace. But she didn't — the watchers saw a dark body shoot out and with one long leap land squarely on the Bear's back.

"The surprised brute reared and tried to throw her off, he frantically clawed the air and tried to reach her, then he rolled on the ground; the Lion let go and with another spring was at his throat. The animals were too far away for the watchers to observe closely the details of the fight, but it must have been interesting while it lasted. As it was, they thrashed about and finally, locked in each other's embrace, rolled over the edge and tumbled down the hillside, over and over into the gulch below. The miners found them in the creek bed, both dead, with almost every bone broken."

The Cougar takes readily to the trees, being a much better climber than the Jaguar. But it almost always hunts upon the ground, trying to creep stealthily up to its victim, and to spring upon it before its presence is even suspected. It scarcely ever ventures to attack a man, but will follow him for a long distance as though waiting an opportunity to pounce upon him unawares. But if he suddenly turns and faces the animal, it will always slink away, even if he is quite unarmed. Sometimes too, it will allow itself to be killed without attempting to defend itself at all; so farmers have a rather poor opinion of its courage. The farmers, however, have very good reason for dreading the animal, for it is a terrible enemy to sheep, and has been known to kill as many as fifty in a single night. And it will also leap suddenly upon a horse or cow and break their necks, just as the Jaguar does.

Although, in some ways cowardly, the Cougar will often fight the Jaguar itself. It is the weaker animal of the two, but is so exceedingly quick in its movements, and makes such excellent use of its teeth and claws, that in many cases it gets the better of the battle.

Hunting a Cougar is a highly exciting sport, because of the element of the unexpected. Mr. Charles J. Lisle thus describes such a hunt in Idaho: "Bursting over the little knoll directly ahead of us they came. A long, lithe beast, like a silvery brown shadow, that traveled in unbelievably long leaps, was the first to come in view. I do not think it saw us; but it had run a long way — far longer than a Cougar will usually travel ahead of a pack of hounds — and it was due to take a tree. There was a big-limbed red fir straight ahead of it, standing out apart from all the others. The limbs grew down close to the ground, making it easy to climb. Up the tree sprang the great Cat, not farther than the width of a street from where we stood.

"Hardly had the Cougar reached the middle of the tree and settled down on a comfortable limb when the dogs burst over the crest of the knoll. They were so close that they must have been hunting partly by sight the last few minutes and they were crazed with excitement. As the hunters started in to surround the foot of the tree where the Cougar was, the dogs came at us with the ferocity of a pack of wolves. Williams called sharply to the pack, and none of them bit him; but two of our party were bitten before the dogs realized that we were not the Cougar!

"Meanwhile, the great Cat lay flattened out on the limb of the tree, fifty feet above the

ground. It was a pretty shot, one that no one could miss. One of the hunters drew up his rifle, took a quick but careful aim, and put a 30.30 bullet through the eye of the big beast. There was a crash as the nearly 200 pounds of Cougar fell down through the small limbs to the earth. Then the dogs leaped upon the prostrate foe — a foe that would have attacked as willingly if it had been uninjured and alive, but that alive would have killed in detail ten times as many dogs as there were in the pack — and it was only by the most violent exertions that Williams could draw them off. Fortunately, the Cougar was dead and had not the power to fight back, otherwise the pack would have been badly cut up."

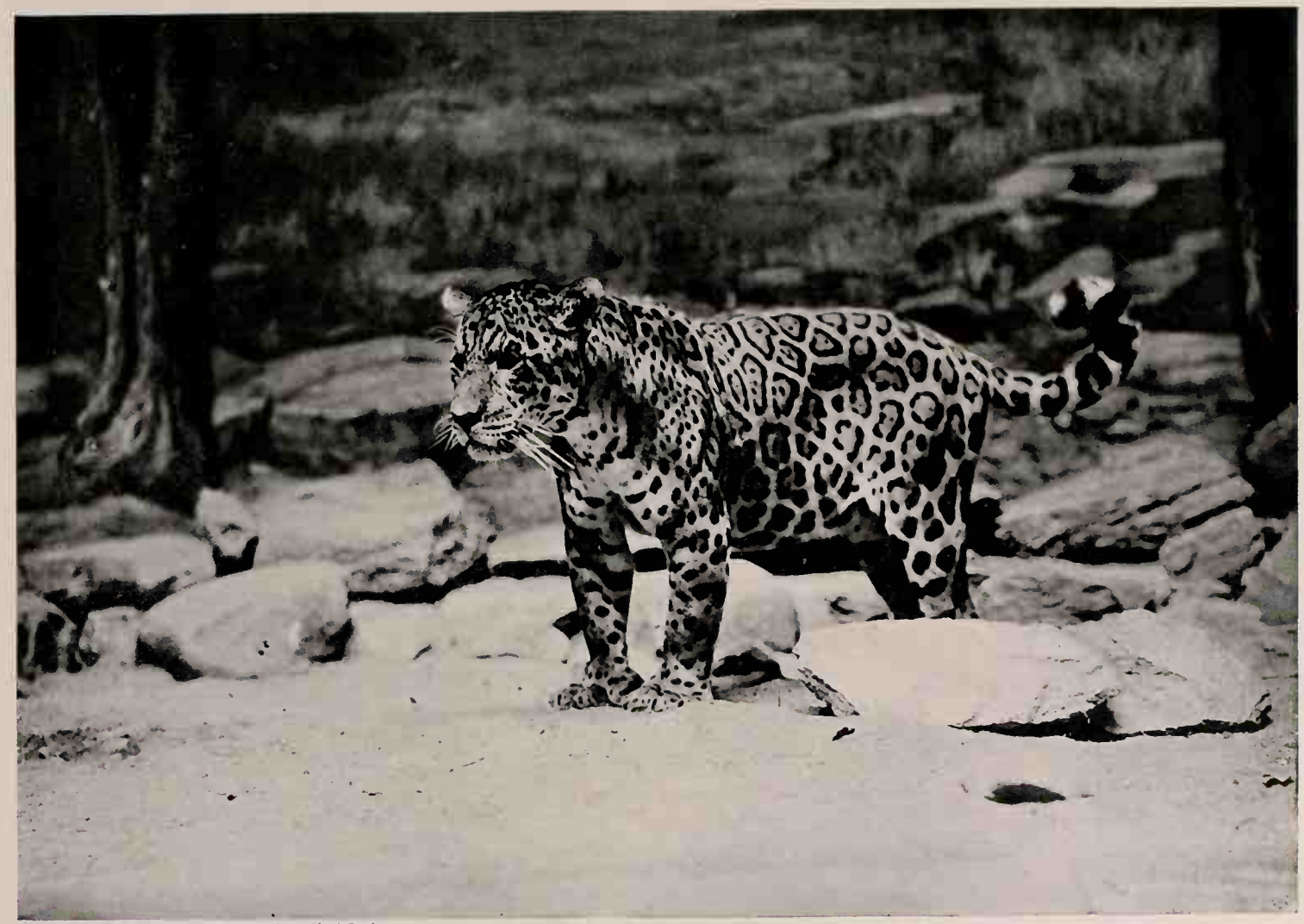
Colonel Roosevelt says of the Cougar's peculiar traits: "It is the special enemy of the Mountain Sheep. In 1886, while hunting White Goats north of Clarke's Fork of the Columbia, in a region where Cougars were common, I found them preying as freely on the Goats as on the Deer. It rarely catches Antelope, but is quick to seize Rabbits, other small beasts and even Porcupines.

"No animal, not even the Wolf, is so rarely seen or so difficult to get without dogs. On the other hand, no other wild beast of its size and power is so easy to kill by the aid of dogs. There are many contradictions in its character. Like the American Wolf, it is certainly very much afraid of man; yet it habitually follows the trail of the hunter or solitary traveler, dogging his footsteps, itself always unseen. When hungry it will seize and carry off any dog, yet it will sometimes go up a tree when pursued even by a single small dog, wholly unable to do it the least harm. It is small wonder that the average frontier settler should grow to regard almost with superstition the great furtive Cat which he never sees but of whose presence he is ever aware. The Cougar is as large, as powerful and as formidably armed as the Indian Panther, and quite as well able to attack man; yet the instances of its having done so are exceedingly rare. But it is foolish to deny that such attacks on human beings ever occur. It cannot be too often repeated that we must never lose sight of the individual variation in character and conduct among wild beasts."

Photograph by W. L. Finley

COUGAR KITTEN

This pretty little Cougar kitten is evidently meditating upon something interesting. Note the crafty expression even in the very young animal



By permission of the New York Zoological Society

"SENOR LOPEZ"

The famous Jaguar that has thrived for many years in captivity, in the New York Zoological Park

JAGUAR

Felis hernandezii (*Gray*) = Felis onca *Linnaeus*

General Description.— Largest of the North American Cats. Body larger and heavier than that of Cougar; tail less than half the length of head and body; body spotted; head very large proportionally; jaws powerful; dentition heavy; neck short and thick; color in general golden yellow dotted with hollow spots or rosettes of black.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{1-1}{1-1} = 30$.

Pelage.— ADULTS: Sexes similar. No seasonal variation. Color variable; usual pattern, above brownish or golden-yellow; beneath, white spotted with black; shoulders, neck and head covered with small black spots; body covered with large rosettes or hollow areas of black with one or more black spots in the center and arranged in from five to seven rows; black spot at opening of mouth; tail ringed with black; lips, throat, underparts and under side of tail white; ear behind black, buffy spot near tip; hair close and soft. YOUNG: Tawny gray spotted with black.

Measurements.— Males average larger than females, probably one-fourth. Length, 6 to 8 feet; tail, 20 to 24 inches. Weight of male, 150 to 250 pounds. Weight of female, 120 pounds.

Range.— Red River of Louisiana, and Texas southward into Mexico.

Food.— Deer and other wild animals, pigs, cattle, horses.

Remarks.— This powerful, handsome Cat reaches the United States only as a wanderer from Mexico, as the country north of the Rio Grande is only the extreme edge of its range. There is but the one species known to cross over, and of recent years this has been rarely encountered.

The Jaguar is the largest of all the spotted Cats, being next in size to the Tiger, but second to none in fierceness. South of the Rio Grande it is usually called "El Tigre" (pronounced "Teagre"). Though more essentially intertropical than most of the large felines, its range at one time extended as far north and east as Arkansas. James Capen Adams, better known perhaps as "Grizzly Adams," stated that in the year 1854, in the mountains of Southern Colorado, he met a pair of Jaguars, followed by two cubs. There is no doubt, however, that the Jaguar ranged as far north as latitude 37°, but like many others of our large-game animals, has gradually receded before the trend of civilization. Of late years a few have been taken in Arizona, and in 1910 one was shot in Central Western Texas. At the present writing there are still a few Jaguars within the borders of the United States, but to meet with one is becoming a rare occurrence. From the Rio Grande south they become plentiful, ranging through Mexico, Central America, and as far south as Patagonia in South America.

Unlike the Cougar, Jaguars seem to require a constant supply of water. In contradiction of this, and showing a well-known fact that animals will frequently alter their generally conceded habits, according to their changed surroundings, the Jaguar is found on the great pampas to the north of Patagonia, a place totally unfitted to its usual habits, where it has been attracted by the abundance of mammalian prey.

Few animals surpass the Jaguar in point of beauty, and none in agility or stealth. His every motion is easy and flexible in the highest degree, he bounds among the rocks and trees with an agility truly surprising; now stealing along the ground with the silence of a snake, now crouching with fore-paws extended and his head laid between them, while his checkered tail twitches impatiently and his eyes glare upon his expected victim.

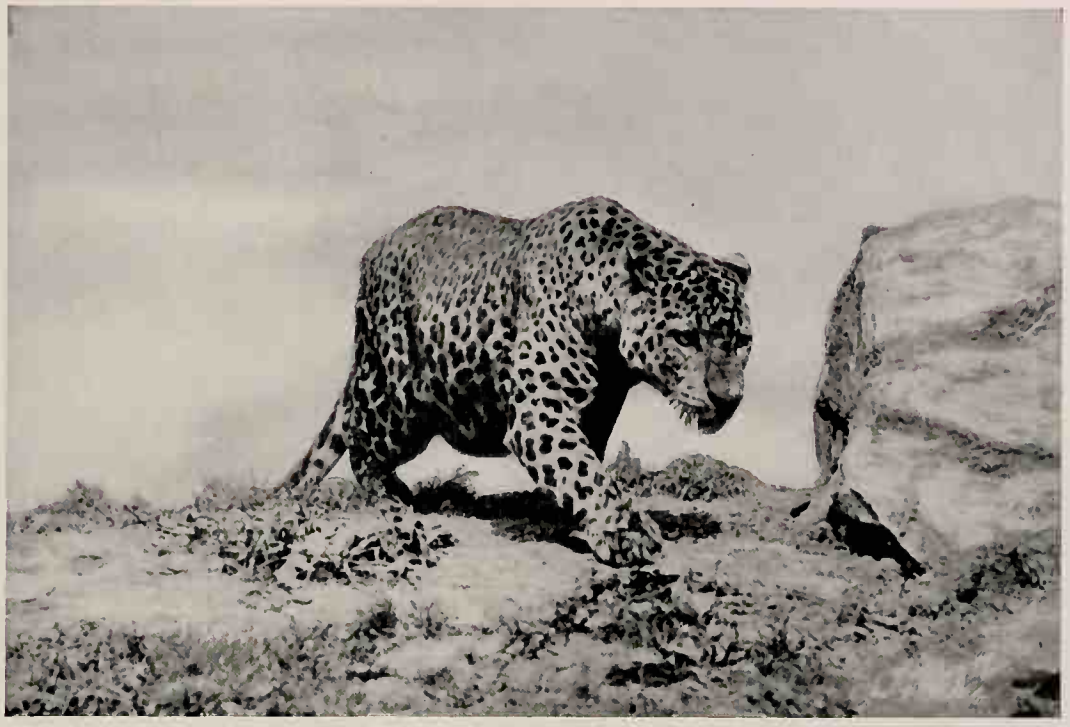
At first glance one might mistake the Jaguar for a heavily built Leopard. In form the Jaguar is thick-set. It does not stand as high at the shoulders as the Cougar, but is a far more powerful animal. Its skull resembles that of a Lion or Tiger, but it is much broader in proportion to its length.

The ground color of the Jaguar varies greatly, ranging from grayish-white to black, while the rosette markings in the two extremes are but faintly visible. The typical color, however, is golden yellow, or a rich tan upon the head, neck, body, outside of legs and tail near the root. The ears are black, with a buff spot at the tip. The nose is usually a pinkish brown. The fleshy part of the lips is black, which, when parted, make the cruel, white fangs stand out in contrast.

The average length of a fine specimen is from six and one-half to seven and one-half feet, the males averaging a foot longer than the

females. The tail is much shorter, compared with that of the Leopard, and in a large male seldom exceeds two feet.

Frequently the Jaguar is forced to take to arboreal life during the rainy season, or floods, and, as may be expected, climbs well among the trees and branches. Here, instead of his retreat being a rocky cavern which he uses as a lair, in one place, he "lays up" upon a huge branch where the thick, gnarled foliage shuts out the sizzling sun, and where he can doze quietly through the long, sweltering hours of the day. The pupil of the Jaguar is circular and is not



JAGUAR

"El Tigre" of Central and South America occasionally wanders as far north as Texas, New Mexico, and Arizona. He is a powerful and beautifully marked animal

adapted to excess light. Like all the *Felidae*, the animal is nocturnal and prowls stealthily about at sunset and throughout the night in search of prey. While occasionally abroad by day, this is not its custom.

The Jaguar leaving his lair shortly after sunset for the night-long prowl, frequently begins to roar like a lion, until he actually begins to hunt. Jaguars are usually noisy animals, especially during the pairing season and upon stormy nights, when their harsh, rasping roar vibrates through the forest, in tones conveying the impression of great power. There is a widespread difference of opinion, however, as to the tone of his voice, and to the extent he employs it, some insisting that the great Cat is decidedly silent. He may be quiet or noisy, depending on locality, or weather. The English naturalist, Charles Waterton, who spent ten years in the wilds of Guiana, wrote: "During the night the Jaguars roared and grumbled in the forests as though the world was going wrong with them."

Jaguars are indiscriminate feeders and their appetite is a ravenous one; so long as an animal has blood in its body, whether it be red or white, it does not come amiss to their taste. From bugs and lizards to all quadrupeds that inhabit their range, they prey upon them promiscuously, including domestic animals, such as horses, cattle and especially calves and dogs.

In the tropics they also capture for food, the tapir, peccary, agouti, marsh deer, wild fowl, and consume large numbers of fresh water turtles and their eggs. The Jaguar swims well and does not hesitate to follow turtles into the water. Often the great Cat, by a dexterous stroke of his paw, will flip a fish up onto the bank, and this practice seems to be engaged in both for sport and for gain; for all animals, no matter how serious a life they lead, must play a little sometimes, and the Cat family particularly are so inclined.

There are innumerable accounts by reliable men of instances where Jaguars have attacked and killed human beings of their own accord. There are, too, many records showing that they have turned and charged when come upon, or when being pursued by hunters. It is the present observer's opinion, however, that, in the majority of cases, if they are given an option on the safe side of retreat they are more inclined to make off. If the Jaguar does intend to attack, he usually does so at once, and without the usual warning of the Lion and Tiger, which is indicated by throwing the tail up, baring the teeth and uttering violent growls. The great spotted Cat runs with belly almost to the ground with incredible rapidity until it is within a few feet of its adversary, then springs to the shoulders, while it sinks its fangs in the neck and lacerates the body with its great claws.

Conditions being favorable, the female, after attaining the age of three years, brings forth from two to four cubs yearly (two being the usual number), which are about 100 days in gestation, and which when about two or three weeks old are able to follow the mother. Jaguars are monogamous, both the male and female assisting in bringing up the young. At the end of a year they usually shift for themselves, but it is about five years before they attain their full growth. The splendid male Jaguar, "Senor Lopez," was presented to the New York Zoological Park in 1901; he was full grown when he arrived, so that at the present writing he must be at least twenty-one.

The Jaguar and Puma frequently occupy the same range, and there seems to be a decided enmity between them; though the Puma is considered less formidable and less daring, it is, nevertheless, the occasional persecutor of its neighbor.

Like all animals with retractile claws, the Jaguar delights in sharpening them, as it is called; but it is not for this purpose that it scratches the bark on either side of a tree trunk. The object of this practice is to tear off the ragged ends and to cleanse them, and not for the purpose of sharpening them, as is generally supposed. Some assert that each animal has an especial tree to which he repairs for the purpose, and a common method of ascertaining if a Jaguar is in the neighborhood is to examine the trunks of the trees.

Next to hunting the Lion or the Tiger there is no more thrilling sport than the pursuit of the American Tiger. Sportsmen and lovers of animal life are giving more attention to this superb animal, finding that transportation of the present day makes it possible to explore his haunts within the space of a few days. There is still much to learn about this splendid beast, and those who will go and live with him in his native haunts, as the writer has done, may bring back something that the others have failed to note.

DANIEL J. SINGER.

OCELOT

Felis pardalis *Linnæus*

Other Names.— Tiger Cat, Leopard Cat, Spotted Cat.

General Description.—A medium-sized Cat smaller than the Lynx, with a long slender body, and tail less than half the length of head and body. Form typically cat-like; color pattern striking, made up of irregular stripes and bands of black running lengthwise on a tan or rufus ground color; ears without tufts.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{1-1}{1-1} = 30$.

Pelage.— Sexes similar. No noticeable seasonal variation. Young spotted. Color variable, typical style with upper parts rufous, marked with black lines and spots, some of the latter with rufous centers; flanks and loins yellowish white, striped with rufous, margined with black; legs spotted with black on light buffy ground color; feet buffy-white; cheeks covered by two black lines; chin, throat, breast and belly white, the last two spotted with black; tail dark buff banded and spotted with black, tip blackish. Hair close, glossy and soft.

Measurements.— Length, 38 inches; tail, 15 inches. Weight, 36 pounds.

Range.— Texas from Red River southward in forested regions.

Food.— Small mammals and birds.

Remarks.— Like the Jaguar, the Ocelot is a southern visitor, Texas being its northern limit. No two skins of this animal are ever just alike, so variable are the pattern and the coloration, but so characteristic are its markings that it need be confused with no other American Cat. Only one species crosses over into Texas.

If one talks with hunters or ranchmen about Ocelots, the probability is that they will refer to them as Leopard Cats or Spotted Cats, either of which is by no means a bad designation for them. Ocelots are about the size of the Wild Cat, or Lynx, though of somewhat different build, and with a long tail. They get their name of Leopard Cats, from their beautifully marked fur, resembling in color that of the Leopard; but, instead of being spotted, it is covered with horizontal stripes and bands of black. There is great variety in the marking and coloration of this beautiful animal, so much indeed that Dr. Elliot says: "To vary from each other in the hue and

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OCELOT

Like most of the Cat tribe, the Ocelot prefers the night to the day, and may seldom be seen abroad until after sundown

arrangement of the spots and stripes of their coats seems to be one of the chief efforts of the existence of these Cats, and, as if not content with differing from his fellows, an Ocelot usually succeeds in exhibiting a distinct pattern on each of his sides, so that he may be said to differ from himself."

Formerly the Ocelot was seen in Louisiana and Arkansas, but it is doubtful whether it is now to be found in the United States beyond the boundaries of the State of Texas. It prefers brushy and timbered country, is an excellent climber, and in its native haunts will spend hours on the lower limbs of trees waiting patiently and watching intently for its prey. Being especially fond of lambs, young pigs, and kids, Ocelots thus cause much damage to the ranchmen. They are believed to kill turkeys and fawns also, and what they can not eat at the time they will hide under a heap of leaves.

Occasionally, while hunting for other game, the dogs will tree an Ocelot. Mr. Howard Lacey, a Texas naturalist, narrates an experience of this kind: "At the head of the Frio river, the hounds struck a hot trail and were just beginning to get off well together when a splendid male Ocelot sprang into a large cedar close to us. Thinking the hounds might be on a bear trail, I shot the Cat at once, put him behind me on the saddle, and made after the hounds, that were getting off at a good pace. They ran about two miles and then treed a female Ocelot in the bottom of a steep canyon. I think the two were together when we started them, and that they often go in pairs. They are not common here, but I fancy that they often rest in trees and so escape the dogs. They are heavier and more muscular than the Bobcat, and our hounds, that always make short work of a Bobcat, find the Leopard Cat a tough proposition. Unlike the Bobcat, they have the strong odor peculiar to the larger felines, and I never killed one without being reminded of the Lion house at the London Zoo."

Little is known of the breeding habits of the Ocelot. The young are born in late October or early November, and there are usually two kittens at a birth. In this connection Mr. Lacey supplies the following useful information: "I have never had the luck to find any kittens, but a friend of mine ran a female into a cave with his hounds and killed her; then the dogs went into the cave and brought out two kittens a few weeks old. This was in November. Another of my neighbors killed a female and two kittens in a cave near here. This was also in November, and when captured the kittens had not yet got their eyes open."

JAGUARONDI

Felis jaguarondi *Fischer*

Other Name.— Yagourondi.

General Description.— A little smaller in size than the Ocelot, with even more slender body. Body elongate; legs short; tail as long as body with head; general color grizzled brownish-gray; a sinuous cat with somewhat the appearance of a large member of the Weasel tribe.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{1-1}{1-1} = 30$.

Pelage.— Sexes similar and no seasonal variation. General color brownish-gray with hairs annulated and black-tipped, the whole giving a somewhat grizzled appearance, with brown body color; tail like body or sometimes black with rufous tinge, and extreme tips of hair white.

Measurements.— Length, 30 inches; tail, 14 inches.

Range.— South of the United States, but occasionally crossing the Rio Grande into Texas.

Food.— Small mammals and birds.

Remarks.— Like the Ocelot and the Jaguar, the Jaguarondi is not a typical North American mammal if we consider the Rio Grande as a southern limit. There is but the one form of this animal known to reach Texas, although in its southern distribution it is subdivided into several varieties. Some authorities hold that the Eyra, the *Felis eyra* of other authors, is a color phase of the Jaguarondi. Certain it is that the Eyra is very similar to the Jaguarondi, and differs from it only in being a rich brownish red instead of a grizzled brownish-gray, the proportion of the two animals being the same. There are no related species in this country.

This little-known American Cat is an inhabitant of southern Texas, ranging thence southward to Paraguay, east of the Andes Mountains. In appearance it is not unlike an Otter; and some individuals of the species are of a grizzled brownish-gray, the hairs being black-tipped. A closely allied species, the Eyra, a rich brownish-red animal, with long and slender body and a very long tail, is found around the Mexican border. These species are without streaks or spots, and are commonly spoken of as the Gray and Red Cats. Of these differences in color Mr. Vernon Bailey says (in "A Biological Survey of Texas"): "A study of five skins and skulls of the Red Cats and six of the Gray from southern Texas and eastern Mexico, reveals no constant difference other than color. The striking coincidence of range and similarity of habits, as well as of structure, of the Red and Gray Cats strengthens the evidence tending to show that these supposedly distinct species present only another case of dichromatism, comparable to the Black and Cinnamon Bear and the red and gray phases of the screech owl."

Concerning the habits of these animals Mr. B. F. Armstrong says: "These Cats inhabit the densest thickets where the timber (mesquite) is not very high, but the underbrush — catsclaw and granjeno — is very thick and impenetrable for any large-sized animal. Their food is mice, rats, birds and rabbits. Their slender bodies and agile movements enable them to capture their prey in the thickest of places. They climb trees, as I have shot them out of trees at night by 'shining their eyes' while Deer hunting. I capture them by burying traps at intervals along the trails that run through these thick places. I don't think they have any regular time for breeding, as I have seen young in both summer and winter, born probably in August and March. They move around a good deal in daytime, as I have often seen them come down to a pond to drink at midday, and seen them dart through the brush in daytime. They are exceedingly hard to tame."

In the New York Zoological Park there is a fine specimen of the Jaguarondi, which often passes unrecognized; for, as Dr. Hornaday says, "it is so seldom seen in captivity that comparatively few persons north of the Rio Grande are aware of its existence."

CANADA LYNX

Lynx canadensis *Kerr*

General Description.— A stout-bodied, long-legged cat about the size of a good-sized cocker spaniel. Ears prominent, tufted; fur dense and long; feet very large; claws sharp and strong; tail very short and blunt; legs very long giving animal a grotesque appearance; a ruff of long hairs on sides of head.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{2-2}{2-2}$; Molars, $\frac{1-1}{1-1} = 28$.

Pelage.— Adults: Sexes similar. Seasonal variation not conspicuous, color in winter paler and grayer than in summer. General color light gray more or less grizzled with brown, darker on the head and back where the long hairs are black with occasional white tips; belly and throat grayish white; ears behind, black with central spot of whitish; ear tufts brownish black usually more than an inch and a half long; black spots at corners of mouth; black bars on ruff at sides of head, and black tip on tail; a few dusky spots on inside.

Measurements.— Length, 36 inches; tail, 4 inches; hind foot, 9½ inches. Male rather larger than female. Weight of male, 25 to 40 pounds.

Range.— Boreal America from the latitude of Maine to 60° N., and from Atlantic to Pacific Oceans.

Food.— Any mammal that it can kill, and birds.

Remarks.— The Canada Lynx need be confused with no other of the North American Cats, with the possible exception of its very near relative, the Bay Lynx or Wild Cat, because of its long legs, large paws, bobbed tail and tufted ears. From the Bay Lynx it may be distinguished by its unringed tail, tufted ears and larger size as well as less prominent color differences. This group has been separated into three varieties.

Related Species

Canada Lynx.— *Lynx canadensis canadensis* Kerr. Typical animal as described above. Boreal North America from latitude of Maine to 60° N., and from Atlantic to Pacific Oceans, possibly only south of Alaska.

Alaska Lynx.— *Lynx canadensis mollipilosus* Stone. Browner in color, otherwise like Canada Lynx. Alaska.

Newfoundland Lynx.— *Lynx subsolanus* Bangs. Size of Canada Lynx, but darker. Newfoundland.

By permission of the New York Zoological Society

CANADA LYNX

One of the handsomest of the Cats, and also exceedingly active and muscular. Note the enormous fore paw

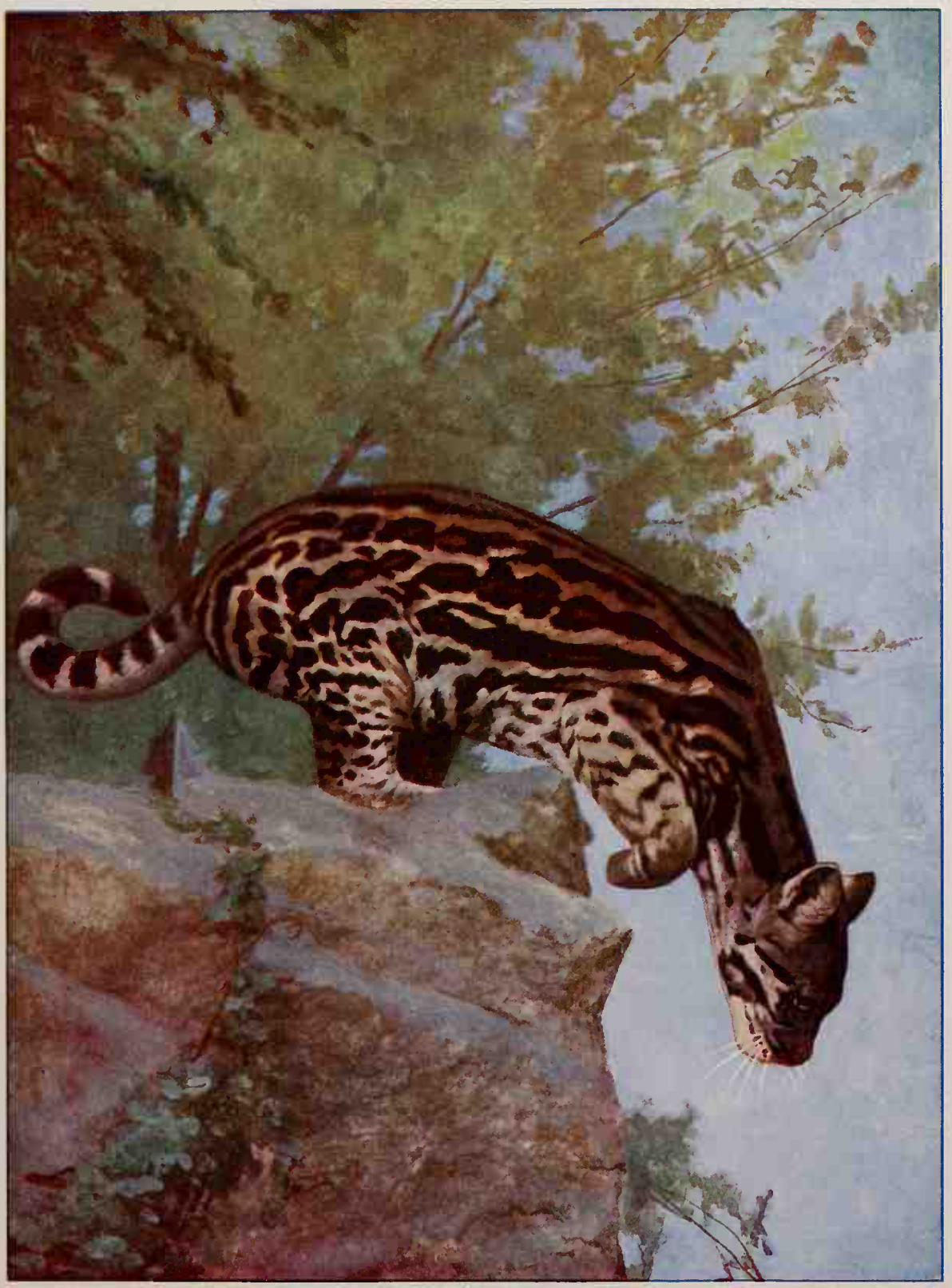
The Canada Lynx is one of the most widely known of northern animals. It is the "Lucivee" (*Loup cervier*) of Canadians. It has a somewhat clumsy appearance, its legs being very muscular and its paws enormously disproportionate to its lean body. The color of its coat is usually a dark gray with chestnut tinge, and the shading renders it indistinct against any background. It is described by Mr. J. C. Nattrass as "an extremely wary and timid animal, and possessing the faculty of concealment to a wonderful degree. He will, like the Cougar, hide himself on a small limb, flattening himself out thereon so that he is almost concealed; and only the most vigilant and well-trained eye can discover him." Its main food consists of cotton-tail rabbits, mice and small birds; it is partial also to the heads of grouse, and it delights in a small deer. It is very clever in unearthing deer, sheep, and young pigs which the Cougar has hidden away for future consumption.

Strangely enough, although such a powerful animal, the Lynx is not by any means tenacious of life, a slight blow on the back sufficing to kill it. It is a very good swimmer. Mr. Edward A. Preble, when in the upper Mackenzie region, saw one cross the Nahanni river. "It swam readily in the swift current, and on reaching the shore bounded away into the forest, apparently little fatigued by its violent exertions." In the same region "the Indians capture the Lynx by snaring, the noose being made of heavy twine or babiche. In setting the snare, a circular inclosure about five feet in diameter is made by sticking pieces of brush into the crusted snow. One or more openings are left, in which the noose is placed at the proper height, so that the animal attempting to enter the pen will put its head into the loop. In the center of the inclosure is placed a split stick smeared with the contents of the musk glands of the Beaver, sometimes mixed with perfumery of some sort, which serves to attract the animal. The snare is attached to the middle of a stout stick three or four feet long, which acts as a drag when the animal is caught. It thus generally becomes entangled in the brush and after a few struggles remains passive, and, if the weather is cold, quickly freezes to death. The flesh of the Lynx is said to be very palatable, and is eaten by the natives and to some extent by the white residents."

Unlike the Bobcat, the Canada Lynx seldom invades the farmyard; it dwells in the deep forests far from the haunts of man. Stone and Cram think that the Lynx "must necessarily go without food often for days together in the winter, glad enough perhaps to pull some frozen scrap of flesh or skin out of the snow, dropped there by some more fortunate hunters weeks before. The lack of insect scavengers is not felt in the woods in winter; every scrap of flesh that is scattered is wanted by one warm-blooded creature or another before warm weather comes again. The Lynx appears to have its summer home in tangled thickets of young growth, where the interlocking branches of fallen trees afford protection. Here the ill-natured kittens [usually two at a birth] are raised and taught to hunt."

A female Lynx, owned by Mr. J. C. Nattrass, had been trained as a kitten and brought up in his family as a domestic cat. It lost many of the traits of its wild kin, and acquired others of the house cat. Says Mr. Nattrass: "She is a beautifully marked animal. She shows all the markings of her grandfather except the tufted and pencilled ears and the heavy limbs. She is a gentle, affectionate, and intelligent animal. The children can tease her with impunity; but game must never be allowed near her, for when her teeth close on a game bird, her wild instincts are aroused. She is then a fury, and will fight to the death. While cleaning some grouse one day, several of them being laid out on the table, she came purring up, rubbing her arched back caressingly against my knee, when she got her eyes on the birds. She seized one in her teeth, and started to make off with it to the bushes. I seized her by the tail and attempted to take the bird from her, when all her wild instincts sprang into instant play. Her fur turned the wrong way, her tail bushed out, her sharp white claws were displayed, while her eyes blazed with fury. Fighting like a demon, she clung to the grouse with her sharp teeth. I became thoroughly indignant, lifted her aloft, and banged her down on a log with considerable force; so heartily, indeed, that the grouse rolled into the bushes. After the trouble was over, she calmed down into the same old serene and complacent, purring pussy, showing no malice — in fact, seeming to forget all about the matter."

The Lynx is found as far south as the Adirondack Mountains. In the Adirondacks, where it is nowhere common, it preys, according to Dr. Hart Merriam, "upon the northern hare, and such other small mammals as it can catch, and upon the ruffed grouse and spruce partridge. It has been known to devour pigs, lambs, and young fawns; but the accounts of



OCELOT FROM CENTRAL AMERICA

This is one of the most beautifully marked of all Mammals. The ornamental coloring is seldom quite the same in any two specimens.

its attacking full-grown deer are not to be credited. Its haunts are in the deep forests and bush districts, remote from the paths of man; and consequently it rarely intrudes upon the barnyard. Its ordinary gait when in a hurry is a long gallop, like that of the hare, and it is said to swim well. The female commonly has two young at a birth, her lair being located in a cavern or hollow tree."

When leaping over the ground, with back arched, and tail so short as to be almost indiscernible, it presents an appearance that has been described by hunters and backwoodsmen as laughable and peculiar in the extreme.

The Lynx is seldom hunted systematically, as are other game animals, unless it be by professional hunters or trappers, who value it for the pelt. With them the usual method is to hunt it with dogs trained to follow the trail by scent. In other cases the track is followed through the snow, but hunters following such a lead must be prepared for a long arduous chase of many hours, because of its combination of cunning, agility, and endurance.

WILD CAT

Lynx ruffus (*Güldenstaedt*)

Other Names.— Bobcat, Bay Lynx, Red Lynx.

General Description.— Very similar to Canadian Lynx q. v. but rather smaller and with detailed differences. Form thick-set; legs long, tail short but longer than that of Canadian Lynx; ears prominent but not conspicuously tufted; feet large but smaller than those of Canadian Lynx; ruff of hair on side of head. General color pale rufous-brown, spotted on sides with dark-brown; fur soft and full.

Dental Formula.— Same as that given for Canadian Lynx.

Pelage.— Sexes similar. No very noticeable seasonal variation. Adults: Yellowish-brown above, spotted on sides with dark-brown; brown stripe on forehead and one on back and tail; underparts yellowish-white spotted with black; legs yellowish-brown spotted with black on outside, dull white on underside, barred with black; chin and throat whitish; breast white barred with black; two white bars across cheek; ears tipped with black; tail with broken bars of dark brown on upper surface, end spotted.

Measurements.— Length, 36 inches; tail, 6½ inches; hind foot, 7 inches. Weight, 20 pounds.

Range.— Central North America from southern Georgia to Maine.

Food.— Mammals and birds.

Remarks.— The Wild Cats form rather a larger group containing more species than are to be found in that section of the genus which contains the Canadian Lynx. They range over a much more diversified habitat and consequently more variations in size and color are met with. The distinguishing features between the Canadian Lynx and the Wild Cat have been set forth in the synopsis on the Lynx, as well as in the general characters outlined above. Some eleven species of Wild Cats are known from the Rio Grande northward.

Related Species

Bay Lynx, or Wild Cat.— *Lynx ruffus ruffus* (Güldenstaedt). Typical animal of the above description. Eastern North America from southern Canada to the Gulf States.

Florida Wild Cat.— *Lynx ruffus floridanus* (Rafinesque). Feet smaller; darker in color; spotted. Florida.

Texas Wild Cat.— *Lynx ruffus texensis* (Allen). Chestnut brown above, spotted and sprinkled with black; size small. Texas and New Mexico to southern California.

Desert Wild Cat.— *Lynx ruffus eremicus* Mearns. A pale desert form. Above, grayish tawny olive, more or less mottled or spotted with brown or blackish, usually with pair of narrow interrupted black stripes on back; an indefinite whitish eye ring surrounding black eyelids; whiskers with several rows of small black spots at their bases; convex surface of ears black, with triangular pale gray spot; upper side of tail similar to back, with black tip, and one to six black bars; beneath grayish-white with black spot on inner side of limbs. A white, buffy or tawny band across breast; belly white, spotted with black. Central and southern California.

Northwest Wild Cat.— *Lynx fasciatus fasciatus* Rafinesque. Fur very full and soft. Color rich reddish chestnut-brown above; pale on sides and throat; belly white spotted with black; terminal third of tail black. Oregon and Washington.

Gray Wild Cat.— *Lynx fasciatus pallescens* Merriam. Smaller and paler than Northwest Wild Cat. California, Oregon and Washington.

California Wild Cat.— *Lynx fasciatus oculeus* Bangs. Back dusky, lacking ferruginous color. Coast region of California north of San Francisco Bay.

Plateau Wild Cat.— *Lynx baileyi* Merriam. Like typical Wild Cat, but paler above and with shorter tail. Arizona.

Uinta Wild Cat.— *Lynx uinta* Merriam. Above buffy, grizzled with gray and black. No distinct spots above. Utah, Colorado, Wyoming.

Giant Bobcat.— *Lynx gigas* Bangs. Largest of the Lynxes. Nova Scotia.

The distinguishing feature of the Wild Cat is its short and rather bushy tail. Compared with the domestic cat, it stands somewhat higher, and has a coarser and rougher head. It is an inhabitant of the United States eastward of the Great Plains, with allied varieties in Nova Scotia, Florida, Texas, and California. Its fur, which is rather heavy and thick, is usually of a yellowish brown color with a reddish tinge, and a blackish stripe down the back; the under parts are white spotted with black. There are also spotted varieties.

Photograph by H. R. Wolmsley

WILD CAT

This fellow has been cornered, and while "Bob cats" do not usually show fight, it is well for the intruder to be wary

Wild Cats feed upon mice, squirrels, rabbits, grouse, and various small birds, and, not having the perseverance of the Weasel and Fox in pursuing, they lie in wait for their prey, springing out suddenly upon it. In settled districts they invade the farmyards, carrying off chickens, ducks, geese, and turkeys, as well as little pigs and lambs. As, however, they are first-class mousers, it is probable that they more than repay, by their destruction of noxious rodents, the depredations they themselves commit.

According to Stone and Cram, "when the Wild Cat hears the faintest movement in the underbrush, he instantly crouches with all four feet beneath him, and remains perfectly motionless, watching and listening, intent to learn whether it is an enemy to be avoided or possibly game for his dinner. In the latter case, he creeps forward with the utmost caution, planning, if possible, to head off his victim in order to seize it at the first alarm. When out hunting, the Bobcat utters a wild scream from time to time; its object evidently is to startle any creature that may be in hiding near by into betraying its presence by a startled jump. And certainly any animal would require strong nerves to remain unmoved when this jarring yell bursts through the stillness close at hand. It has been described as a low sort of growling, followed by a sudden, quick repeated caterwaul."

Wild Cats during most of the year hunt either alone or in pairs, and they do most of their roaming in the evening and morning twilights, sleeping during the day in the hollow of some tree, or in a cave, or even in the nest of a large bird. Their own nests, which are well-lined with moss, are found in hollow trees and logs. Their young number two to four.

The pelts of the Wild Cat have a ready sale among furriers. Dr. Merriam has eaten its flesh and pronounces it excellent. It is white, very tender, and suggests veal more than any other meat with which he is familiar.

The Texas Wild Cat is a large, dark, and much spotted cousin living in southern and eastern Texas. It is especially abundant "in the dense chaparral of cactus and mesquite along brushy stream bottoms and in the timbered gulches." Away from the towns the animals are most common in places where there is excellent cover such as is afforded by the thick part of the oak brush, where they can be hunted only with dogs, and in the great rose hedges, which are almost impenetrable.

Wild Cat hunting with dogs is a favorite sport in certain parts of the South. The hunters usually take their stands in open spots and wait for the dogs to drive the game within shot. The Wild Cat rarely trees, but usually, rabbit-like, runs round and round in a limited circle depending on outrunning or dodging the dogs. Mr. Bailey once shot a Wild Cat in front of the hounds as it passed him for the third time. "It did not seem tired or much alarmed, but easily kept out of sight of the dogs." When opened, "the stomach of this individual was full of venison that had not been perfectly fresh when eaten, probably from a Deer that had been wounded by some hunters a week before."

The Plateau Wild Cat gets its name from inhabiting the high plateau of Arizona, Utah, and Colorado. It is paler than the preceding, has a shorter tail, and a softer fur. It is found also in the mountains and Staked Plains regions of western Texas. Mr. Vernon Bailey, in whose honor Dr. Merriam named this species, writes ("A Biological Survey of Texas"): "The country occupied by this Plateau Wild Cat is mainly open, arid, and rocky. Canyons, gulches and cliffs are its favorite haunts, while caves and clefts in the rocks furnish dens and safe retreats from which hunting excursions are made. . . . Fresh tracks are frequently seen where the Cats have followed the lines of the cliffs, crept along narrow shelves of rocks from one wood rat's den to another, or walked noiselessly in the dust under and around the great boulders, where the cotton-tails hide. Most of the Wild Cat's hunting is done at night, but occasionally one is surprised at midday crossing a valley to another cliff, or found toward evening getting an early supper."

One January evening Mr. Bailey, while watching the hawks come into the cottonwoods to roost at sundown, saw "a pair of bright eyes among the branches overhead and slowly traced out the almost invisible form of a Wild Cat flattened along a rough gray branch." As he needed the specimen, he did not wait to see if hawks were the object of the Wild Cat's hunt, but soon secured it.

The Desert Wild Cat, another well-known species, is of a tawny hue which matches well with its barren surroundings. (See detailed description above). Its habits do not differ greatly from others, beyond the change necessitated by local conditions. It is a lithe, bloodthirsty animal that spends many of its waking hours stalking its prey.

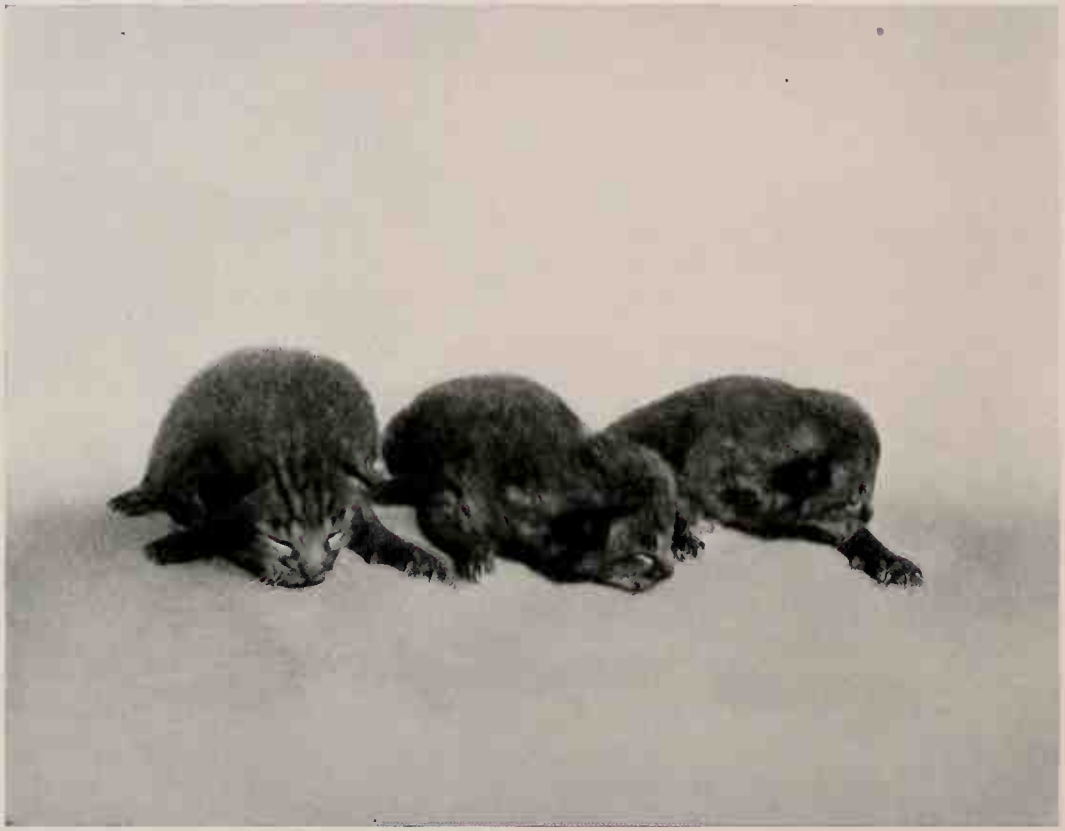
By permission of U. S. Biological Survey

PLATEAU WILD CAT

From a drawing by L. A. Fuertes, showing handsome markings of these Western cats

Says one observer: "While walking along a railroad track, I had an excellent opportunity to watch the method by which the Bobcat hunts Prairie Dogs. I was just emerging from a deep cut when I saw a large reddish Bobcat at a distance of not over forty feet. It was sneaking through the scattering greasewood bushes flat upon its belly, its short tail twitching nervously, and the excited chattering of the Prairie Dogs on a neighboring flat showed that its approach had been noted by the alert animals. One large old Prairie Dog in particular, apparently the Cat's intended victim, was seated at its burrow on the edge of the town, chattering in a bantering manner and appearing less frightened than the rest. The burrow was within leaping distance

(about ten feet) of the edge of the greasewood, and in making its approach, the Cat took advantage of every bush, stopping in the cover of each for a few moments. When it reached the last bush and was gathering itself for the final leap, the old Prairie Dog disappeared, but only just in time, as in another moment the Cat landed on the rim of the burrow. Rapid, nervous jerks of the tail showed the Cat's disappointment as it glared about in different directions. Up to this time my presence had not been noted, and not until I had thrown several stones did the Cat see me, whereupon it bounded away across the Dog town in long leaps."



Photograph from the American Museum of Natural History

WILD CAT KITTENS

These small Lynxes were only a few days old when photographed

ORDER OF GNAWING ANIMALS

(Rodentia, or Glires)

THIS is a well defined group of the smaller animals, the commonest distinguishing character being the presence of broad chisel-like incisor teeth adapted for gnawing. Such well-known animals as the Rats, Mice, Squirrels and Hares belong to this order, and it is by far the largest of all in point of numbers. They are found practically all over the world.

Rodents have other well-marked traits. The eyes are sharp and bright, the ears well developed. There are no canine teeth, which leaves a gap between the incisors and the molars, and the molar teeth have special adaptations for grinding. The lower jaw is hinged with the skull in such a manner that movement is possible not only up and down, but backward and forward as well, and sidewise to a certain degree. This feature allows the best play of the teeth of the opposing jaws across one another in order to secure grinding of the vegetable fiber. The Rodents live very largely on vegetable food.

The members of this order are fitted for every conceivable nook in nature's economy, for Rodents are found in the trees, on the ground, under its surface, and in the water. One species of the Squirrel family almost flies through the air. For convenience, the order is divided into the sub-order *Simplicidentata* (all Rodents but Hares and Pikas) and the sub-order *Duplicidentata* (Hares and Pikas). These sub-orders are distinguished by the difference in number of the gnawing teeth, the incisors. The Hares and Pikas have four incisors in the upper jaw, a main pair of large ones with enamel extending all around the tooth, and a second pair of small incisors directly behind them. The other Rodents have but one pair above, and the enamel is confined to the cutting face of the tooth.

The following table shows the division of Rodents into families and species in this country:

ORDER OF GNAWING ANIMALS (RODENTIA)

FAMILIES

(In North America)

Squirrels (*Sciuridæ*)
(Typical species)
Gray Squirrel
Red Squirrel
Fox Squirrel
Tuft-eared Squirrel
Flying Squirrel
Spermophile
Chipmunk
Marmot
Prairie Dog

Sewellels (*Aplodontiidæ*)
(Only species)
Sewellel

Porcupines (*Erethizontidæ*)
(Only species)
Porcupine

Conies (*Ochotonidæ*)
(Only species)
Pika

Pocket Gophers (*Geomyidæ*)
(Only species)
Pocket Gophers

Jumping Mice (*Zapodidæ*)
(Only species)
Jumping Mouse

Beavers (*Castoridæ*)
(Only species)
Beaver

Rats and Mice *Muridæ*)
(Typical species)
House Rat
Wood Rat
Cotton Rat
Rice Rat
House Mouse
White-footed Mouse
Lemming Mouse
Meadow Mouse
Red-backed Mouse
Musk-Rat

Hares (*Leporidæ*)
(Typical species)
Arctic Hare
Varying Hare
Jack Rabbit
Pygmy Hare
Cottontail
Swamp Rabbit

Pocket Rats (*Heteromyidæ*)
(Typical species)
Pocket Mouse
Pocket Rat

THE SQUIRREL FAMILY

(Sciuridæ)

WHO does not know and like the Squirrels? Busy, frisking, bright-eyed and graceful, they are among the most interesting neighbors of the woodland. In our public parks they easily become so tame as to approach the passer-by and "hold him up" for food. And yet the Squirrels if unrestricted might become a pest. Their gnawing habits and their tendency to rob birds' nests are points against them. In England they have not been protected or made such pets, as in this country.

Members of this family include the Squirrels, Flying Squirrels, Ground Squirrels, Chipmunks, Marmots, and Prairie Dogs. Their chief family resemblances are rounded and bushy tails which are never scaled. They have twelve or thirteen ribs. Their first upper premolar teeth are very small. The family is a large one with members widely scattered.

EASTERN GRAY SQUIRREL

Sciurus carolinensis *Gmelin*

General Description.— A large, bushy-tailed arboreal Squirrel. Head rounded; ears of moderate height, covered with short hairs; body large but not heavy; tail about half the total length, very broad and bushy; legs fairly short; color yellowish-rusty above; white below; pelage soft. An animal of much more quiet behavior than the Red Squirrel.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3} = 22$.

Pelage.— Adults: Sexes similar. *Summer.* Above dark yellowish-rusty; hairs on tail yellow at base, then black, finally tipped with white; underparts white; ear yellowish-white; soles of feet usually naked. *Winter.* Much the same. Young: Uniformly grayish.

Measurements.— Total length, 18 inches; tail vertebrae, 8.5 inches; hind foot, 2.51 inches.

Range.— Eastern United States from southern New York to northern Florida, west to Indiana, Missouri, and Oklahoma.

Food.— Nuts and acorns.

Related Subspecies

Eastern Gray Squirrel, or Carolina Gray Squirrel. — *Sciurus carolinensis carolinensis* Gmelin. Typical form of the above description. Timbered regions from Florida north to lower Hudson Valley, west through the Alleghenies south of Pennsylvania to Indiana, Missouri, Oklahoma and the edge of the Plains.

Northern Gray Squirrel.— *Sciurus carolinensis leucotis* (Gapper). Larger and grayer; black individuals not uncommon in this variety. Northeastern United States and southern Canada from Illinois, Indiana and Pennsylvania northward to 46° latitude, and west to Minnesota and Iowa.

Florida Gray Squirrel.— *Sciurus carolinensis extimus* Bangs. Smallest of Eastern Gray Squirrels. Color lighter and grayer than Carolina Gray Squirrel. Southern Florida.

The Eastern Gray Squirrels range from New York south along the entire Atlantic seaboard and as far west as the edge of the Plains. The group is divided into five sub-species, based mainly on color characters and size differences. Some of these sub-species have a black color phase or melanistic form in which the animal is black all over, but these are rarer.

The home of the Gray Squirrel in the East is usually to be found in the hollow of a maple, birch, or beech tree, with the entrance among the branches forty to sixty feet from the ground.

Photograph by S. A. Lottridge

EASTERN GRAY SQUIRREL

The Gray Squirrel may be readily tamed, and is a familiar and pleasing inhabitant of many city parks

In the West it frequents the oak and pine. This is the real home, although often a summer house is constructed, which is generally located in the same tree with the other home, so that if the Squirrel becomes frightened, it may run for shelter to the more secure dwelling in the hole of the tree. The summer home may be built for convenience during the time that the young are being reared; perhaps, it is built for sanitary reasons; the temperature may be very much less during the hot weather; or it may be a pleasure house, for a tenting-out period that is so much enjoyed by some of the higher animals. Who knows? The material of the summer house varies considerably, but consists chiefly of sticks, bark, leaves, with a lining of grasses or some other material. The entrance is on the side, the nest from below resembling that of a crow.

The Gray Squirrels do not lay up for winter use quantities of nuts or other food, as do the Chipmunks, for they do not hibernate. When the weather is not severe they roam abroad during the winter. However, the Gray Squirrel, in common with most of our other Squirrels, has the habit of digging holes and hiding a nut or two here and there. It has been argued that this is an idle pastime, and that nuts so concealed in many places could never again be located by the Squirrel, but it must be remembered that the sense of smell is very acute, probably guiding the animal more than memory. It must be this wonderful sense of smell that directs the Squirrel where to dig in the snow, securing from beneath the leaves the nuts that were buried weeks before; or that guides him to a solitary nut tree, or to the grain in a barn.

This stored food constitutes only a part of the Gray Squirrel's winter supply. The other part he must scurry about to find. The beech trees and some others do not drop all of their nuts

Photograph by H. E. Anthony

EASTERN GRAY SQUIRREL

The home of the Eastern Gray Squirrel is usually to be found in a hollow tree, forty feet or more from the ground

at the approach of winter. There still hang a few solitary nuts on each tree, and through a large beech forest the number so left is considerable. But the Gray Squirrel is not the only claimant for the nuts; the Red Squirrel and the red-headed woodpeckers demand the lion's share. The birds seem to think that these nuts are exclusively their property, and vigorously do they protest if a Squirrel appears. One determined woodpecker will sometimes send a Gray Squirrel scampering after a few moments, for the blows from that long sharp bill of his are severe. The Squirrels, being the earlier risers, are often feasting when the birds appear, but

Photograph by Glen Corley

"UP A STUMP"

This Gray Squirrel has evidently found a table ready set to his liking

they beat a hasty retreat before these tri-colored warriors.

The Gray Squirrel has other enemies in feathers, such as the goshawk and the red-tailed hawk. A single hawk, however, can scarcely catch a Gray Squirrel, especially if the Squirrel remains on the tree trunk, which he probably will be wise enough to do, thus being enabled, by dodging, to evade the hawk's claws. The writer never witnessed an encounter of this kind but once, and certainly the Squirrel was "up to the trick;" for he eluded the hawk in the most exasperating manner, chattering and barking the while in a most impudent tone. "Qua-qua-qua-

Photograph by H. T. Middleton

READY FOR HOUSEKEEPING

A pair of Gray Squirrels have just completed a handsome home, and are ready to move in

qua-qua-a-a!" The hawk was angry, the feathers on its head and neck being ruffled as was its spirit. At last it was obliged to retire, leaving the Squirrel at his hunting. I have been informed, however, that the Squirrel does not always get off so nicely, for sometimes the red-tails hunt in pairs, and then the Squirrel has no chance for his life.

Gray Squirrels have a good ear for music, says Dr. C. Hart Merriam, who mentions some experiments with Squirrels which frequented a box of nuts that his father supplied for them during the winter: "They were extremely fond of music, and it affected them in a peculiar manner. Some were not only fascinated, but actually spellbound, by the music-box or guitar. And one particularly weak-minded individual was so unrefined in his taste that if I advanced slowly,

whistling, 'Just before the Battle, Mother,' in as pathetic a tone as I could muster for the occasion, he would permit me even to stroke his back, sometimes expressing his pleasure by making a low purring sound. This was a Gray, and I several times approached and stroked him as above described. I once succeeded in getting near enough to a Black to touch him, whereupon he instantly came to his senses and fled. When listening to music they all acted in very much the same way. They sat bolt upright, inclining a little forward (and if eating a nut, were sure to drop it), letting the forepaws hang listlessly over the breast, and, turning the head to one side in a bewildered sort of a way, assumed a most idiotic expression."

The Gray Squirrel is readily tamed, or semi-tamed and lives contentedly in the city parks. It will come close to the visitor and may be even persuaded to climb one's coat and eat out of the hand. When alarmed, it utters a peculiar rasping cry or bark. It is an arrant coward, being readily driven off by its smaller red cousin.

The family of the Gray Squirrel is usually five in number. The parents are quite devoted and work early and late to feed their youngsters and to provide stores for the winter.

Two families of Gray Squirrels dwelt in amity near the writer's home, until one day a great chattering was heard. The smaller pair of the two were quarreling vociferously with the older ones. What the cause was, none of the "innocent bystanders" knew; but the outcome was easily seen. The older pair decided to move out, and lost no time in acting. They chose an oak tree at least five hundred yards away and the mother Squirrel carried each baby by the back of the neck, much as a cat carries a kitten, down the road and up the tree. Five separate trips were made and all were safely transferred, after which the neighborhood was at peace.

S. A. Lottridge.

WESTERN GRAY SQUIRREL

Sciurus griseus *Ord*

General Description.— Of similar proportions and general appearance to the Eastern Gray Squirrel, but larger, with very large tail.

Dental Formula.— Same as Eastern.

Pelage.— Adults: Sexes similar. Seasonal variation slight. Above, general color mouse-gray, thickly grizzled with white; dull white eye ring; ears never tufted, light-brown at base, dusky at tip; no lateral stripe; undersurface white meeting ashen-gray hue of the sides in a sharply defined line; tail slate-gray mixed with whitish, the hairs tipped with white; undersurface of tail pale ashy-gray centrally, with blackish lateral bands and fringed with white; limbs ashy-gray externally. Young: Similar to adults.

Measurements.— Total length, 22 inches; tail vertebrae, 11 inches; hind foot, 3.1 inches; ear from crown, 1.18 inches.

Range.— Western Washington, Oregon and northern California.

Food.— Seeds of conifers, especially of the pine, and acorns.

Related Subspecies

Western Gray Squirrel, or Columbia Gray Squirrel. — *Sciurus griseus griseus* Ord. Typical animal as described above. Pine and oak forests from southwestern Washington through western Oregon, and most of California.

Black-footed Gray Squirrel.— *Sciurus griseus nigripes* (Bryant). Darker than Western Gray Squirrel. Upper surface of feet slaty or black. From San Francisco southward into Santa Cruz Mountains.

Anthony Gray Squirrel.— *Sciurus griseus anthonyi* (Mearns). Intermediate in color between Western Gray Squirrel and Black-footed Gray Squirrel. Higher mountains of southern California.

The Western Gray Squirrels are noticeably larger and more striking in appearance than the Eastern. The tail is especially long and bushy, and the gray color of the upper parts is much clearer than in the eastern animal. Cranial characters are the basis for placing this animal in a subgenus apart from the Eastern species. This is a small group and has but three subspecies differing mainly in the color of the feet.

The habits of the Western Squirrels are much the same as those of their Eastern cousins. As a rule they are wilder, since they do not dwell near closely settled communities. They prefer the depths of the great pine and oak forests, and are fond of pine seeds and acorns. In the cavities of these trees well up from the ground they rear their families and lay by their winter stores. And always they are on the alert for their enemies,— the greedy Mice; the prowling Red Squirrel; the Hawk above; and the Fox below.

From a drawing by George A. King

EASTERN RED SQUIRREL

The typical markings of this large group of Squirrels are chestnut or reddish brown above, and pure white underneath. The related species are found throughout the United States and Canada, wherever there is timber

EASTERN RED SQUIRREL

Sciurus hudsonicus (*Erxleben*)

Other Names.— Chickaree, Pine Squirrel.

General Description.— A medium-sized Squirrel with bushy tail. Head blunt and rounded; ears fairly large and broad, clothed with short hair; body of moderate proportions; tail nearly as long as head and body, broad and bushy; feet of moderate length, soles furred, pads naked; general color above yellowish-rufous in summer, chestnut rufous in winter. Temperament, nervous and active.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$ or $\frac{1-1}{1-1}$; Molars, $\frac{3-3}{3-3} = 20$ or 22.

Pelage.— Adults: Sexes identical. *Summer.* Upper parts yellowish-rufous; a conspicuous black lateral line between rufous of upper parts and clear white of under parts; everywhere below, pure white; no tufts on ears; tail above like body, beneath, yellowish-gray bordered with black and fringed with yellowish-rufous; upper surface of hind feet and front of fore legs clear ferruginous. *Winter.* Upper parts and dorsal stripe, chestnut rufous; sides olivaceous gray; under parts grayish-white; tail as in summer but fuller; short tufts of hair on ears. Young: Similar to adults but coloration weaker.

Measurements.— Total length, 12 inches; tail vertebrae, 5.5 inches; hind foot, 1.8 inches.

Range.— Boreal North America, Labrador west to Rocky Mountains and Alaska.

Food.— Seeds of conifers and of other plants, nuts, buds, some insects and birds' eggs.

Related Species

Eastern Red Squirrel, or Eastern Chickaree.— *Sciurus hudsonicus hudsonicus* (Erxleben). Typical animal of the above description. Boreal North America north of the United States.

Southern Red Squirrel.— *Sciurus hudsonicus loquax* Bangs. Larger than Eastern Red Squirrel; tail longer; dorsal stripe brighter. Ontario to North Carolina, and west to Minnesota.

Little Red Squirrel.— *Sciurus hudsonicus gymnicus* Bangs. Smallest of the Eastern Red Squirrels; tail with orange-red fringe. Eastern North America south of Labrador to northern New York, west to northern Michigan and northern Minnesota.

Richardson's Chickaree.— *Sciurus hudsonicus richardsonii* (Bachman). Upper surface of tail mostly black, size large. Northern Montana, Idaho, northeastern Washington, and Oregon northward into British Columbia.

Douglas's Chickaree.— *Sciurus douglasii douglasii* Bachman. See special synopsis.

Fremont's Chickaree.— *Sciurus fremonti fremonti* Audubon and Bachman. See special synopsis.

The Red Squirrel in some of its related forms is found in nearly every timbered area in North America. This group of medium-sized Squirrels is divided naturally into several subgroups clearly distinguished by strong color differences. Altogether about twenty species and subspecies of Red Squirrels range north of the Rio Grande and fall easily into three divisions: the first, or Eastern Red Squirrel group in which all the members are clear white below and generally some tone of chestnut, or rufous brown above; the Douglas Red Squirrel group in which the members are bright orange below and reddish above; and the Fremont's Chickaree group in which the members are grayish white below and gray above.

The Red Squirrel is the most frolicsome, alert, curious, and "sassy" of the family to which he belongs. His home is usually in a hollow tree or among the roots, but sometimes he constructs a summer nest of twigs and leaves, located on lofty branches in the forest; but if in an old apple tree, it is usually not more than fifteen feet from the ground.

Nuts form the chief food of the Red Squirrel, but berries, roots, fungi, fruits, seeds of the pine, and, occasionally, animal food, are also eaten. Even in the coniferous forests he, with his intelligence, industry and faculty of adapting himself to circumstances, lives and thrives. If the annual nut crop fails, the other Squirrels are forced to migrate; not so with the Red Squirrel, or Chickaree, as he is often called, for he can subsist upon buds, roots, and even mushrooms — in fact, he is very fond of the last named. Just how a Red Squirrel knows the difference between the poisonous and the non-poisonous varieties has always been a mystery. Mushrooms decay quickly if not gathered at the proper time, and the Red Squirrels, who know this as well as we do, harvest them accordingly. There are also the barberries, chokecherries, partridge berries and greenbrier berries which they add to their store, and last, but quite important in many localities, are the seeds from the cones of the hemlock, pine and spruce.

But the food question is far from being settled for the Red Squirrel, even after the supply which has cost him days and days of arduous toil is gathered, for he has thieving neighbors constantly watching to take advantage of his thrift. He suffers little from his own kind, for

each Red Squirrel is supposed to have a certain territory that belongs to him, and trespassers upon another's preserves are promptly driven away; also he easily vanquishes his larger cousin, the Gray Squirrel, but there are many other hungry wood folk not so easily disposed of, such as the thieving blue jays, which know neither bounds nor limits, and which are ever on the alert for tempting morsels. The Red Squirrel has learned through bitter experience that it is better to have various storehouses for his supplies. Nature and stern necessity have taught him to make ample provisions in the season of abundance for the long winter that is to follow, and the quantity of food stores is often quite

Photograph by the U. S. Biological Survey

FREMONT'S CHICKAREE

Also called Pine Squirrel, from its fondness for pine and spruce cones. This was a young specimen

large. Sometimes as much as a bushel and a half of nuts have been taken from a hollow tree occupied by a pair of Red Squirrels. This probably was the main storehouse, but undoubtedly there were lesser ones which would have considerably increased the amount.

Annoying as the blue jay is, he is a real friend to the Squirrels and other wood dwellers. The Red Squirrel, being a constant target for gunners in some localities, is very shy, and the jay often sounds an alarm note when the hunter is some distance away, thus warning the Squirrel in time to scamper away and hide until the danger is past. The blue jay, and in the northland the Canada jay, have caused the hunters to lose many a good shot, not only at small game, but more particularly at members of the Deer family.

The Red Squirrel is an expert on the subject of nuts, not only in selecting sound and good ones, but also in the manner and certainty with which he gets at the kernel. Concerning this art John Burroughs writes as follows: "There is one thing that the Red Squirrel knows unerringly that I do not know (there are probably several things); that is, on which side of the butternut the meat lies. He always gnaws through the shell so as to strike the kernel broadside, and thus easily extract it; while to my eyes there is no external mark or indication in the form or appearance of the nut, as there is in the hickory-nut, by which I can tell whether the edge or the side of the meat is toward me. But examine any number of nuts that the Squirrels have rifled, and, as a rule, you will find they always drill through the shell at the one spot where the meat will be most exposed. Occationally one makes a mistake, but not often. It stands them in hand to know, and they do know. Doubtless, if butternuts were a main source of my food, and I were compelled to gnaw into them, I should learn, too, on which side my bread was buttered."

In certain parts of the country the Red Squirrel makes inroads upon the farmer's storehouse of grain, and sometimes it ventures even so far as to make a nest for itself in some of the outbuildings.

Although the Red Squirrel is a good provider, food sometimes becomes extremely scarce in the north country, if the spring is very late, and his hunger drives him to drink. He does not slake his thirst at the mountain stream, but taps a maple tree and later the birch. With his sharp, chisel-like teeth he makes an incision in the bark,

either upon the tree trunk or upon the upper side of a limb. The cut in the bark forms a small cavity, in which the sap collects, and as the capacity is small, there may be two or three "drinking fountains" on the same tree.

He is abroad at nearly all times of the day, but retires early, except in the busy nutting season, when he keeps late hours. This Squirrel combines qualities so entirely dissimilar that he is clearly the enigma of the forest. His wonderful inquisitiveness, his exasperating insolence, coupled with all disregard for the ordinary civilities of the wood folk, stamp him "the black sheep of the flock." If you disturb him in your walk, he mounts the nearest tree, and from a limb just out of reach he literally boils over with rage and indignation, jerking his tail and stamping the limb furiously, calling "*chickaree, chickaree, chickaree!*" He barks and spits, and probably says things in Squirrel language that would sound very dreadful in English. He makes little dashes first this way, then that, as though he intended to come down the tree and run you from the premises. He has no more respect for a man than for a dog, and if you sit down and remain motionless, he may either pay no attention to you at all, or his insolence may know no bounds, so fickle and changeable is his disposition.

Those who have tented in the woods far removed from man's influence, must have observed the ungovernable curiosity of the Red Squirrel. Within ten minutes after your camping outfit was landed, he was chattering at you from the tree tops. If he considered you a "squatter" upon his territory, his language indicated it, but if pleased, his every action showed his approbation. Many a time I have been awakened in the early morning by the repeated calls and chuckles of this clown of the forest; nor was he always satisfied in remaining on the outside of my tent, for if I did not appear at what he believed to be the proper time, he might surprise me by coming inside. If you really would like to have him come in, a nut dropped near the entrance would seem to assure him that you were his friend, and the ice once broken he visits you regularly during your stay, accepting food of almost any kind. A few weeks of this, and you become very much attached to the mischievous little rascal, and after camping days are over, the recalling of his escapades is a pleasant memory.

This same curiosity that endears him to some campers makes him a terror in the region of the trappers. Says one observer: "From an overhanging limb he looks on with unfeigned interest while the trapper arranges the bait for the Marten or Fisher; but a moment later he has sprung the trap and is chippering with a fiendish delight. He is often caught, it is true, but a half dozen others are always ready to take his place, and it affords little satisfaction to the hunter, on his lonely rounds through the snow-clad forest, to find a worthless squirrel in his trap, instead of the valuable fur for which it was set."

Many claim that the Red Squirrel is the bird's most deadly enemy, destroying both eggs and young; others are equally positive that the Squirrel does not meddle with nesting birds. I do not precisely agree with either, for circumstances have very much to do with it, and to say that the Red Squirrels as a whole do not rob birds' nests is a very sweeping statement. There are probably both innocent and guilty ones. In other words, I believe it to be largely a habit, formed like any other habit that an animal may have, or that persons may have.

Photograph by H. T. Middleton

CHICKAREE

Holding almost as big a nut as he can manage

Yet, with all his many faults and objectionable traits, his intelligence, his wonderful perseverance, his industry, and the cleverness displayed in his various actions cause him to be tolerated, even though he is an acknowledged nuisance.

S. A. Lottridge.

DOUGLAS'S CHICKAREE

Sciurus douglasii *Bachman*

General Description.— General build as in Eastern Red Squirrel, but coloration strikingly different. Above, dark gray; below, orange.

Dental Formula.— Same as Eastern.

Pelage.— ADULTS: Sexes similar. *Summer.* Olivaceous brown, tinged with reddish, above; orange of variable intensity, below; feet, orange rufous; lateral line conspicuously black; tail above, dark ferruginous with sub-terminal broad black bar; tail fringed with yellowish; underside grizzled rusty. *Winter.* A dark reddish dorsal band; rest of upper parts dark gray; underparts orange grizzled with black; lateral line present; tail as in summer but thicker. YOUNG: Similar to adults but colors weaker.

Measurements.— Total length, 14 inches; tail vertebrae, 5 inches; hind foot, 2 inches.

Range.— Coast region of Oregon and Washington from Cape Blanco to Puget Sound.

FREMONT'S CHICKAREE

Sciurus fremonti *Audubon and Bachman*

Other Name.— Pine Squirrel.

General Description.— Proportions and size about as in Eastern Red Squirrel, but coloration much grayer.

Dental Formula.— Same as Eastern.

Pelage.— ADULTS: *Summer.* Above yellowish-gray; forearm and upper surface of feet ochraceous; lateral line black; beneath, grayish-white; tail above, yellowish-rusty bordered with black and fringed with white; beneath, pale yellowish gray bordered and fringed as above. *Winter.* Above, gray with pale yellowish-rufous dorsal band and obscure dusky lateral line; underparts grayish-white; tail as in summer but thicker. YOUNG: Much the same markings as found in adults.

Range.— Rocky Mountains of Colorado, and Uintah Mountains in Utah.

Photograph by H. T. Middleton

YOUNG CHICKAREES

The Red Squirrel, or Chickaree, is the most frolicsome and also the most quarrelsome of the Squirrel tribe. It will not hesitate to tackle and drive off its larger gray cousin

The Douglas, and the Fremont Red Squirrels are western types which differ in coloration, but only slightly in habits. Mr. Merritt Cary, of the U. S. Biological Survey says: "Like the common Northern Red Squirrel, which it greatly resembles in all respects except color, the Fremont Squirrel feeds chiefly upon pine and spruce cones, which are hoarded in large caches at the bases of trees, beneath logs, and among rocks. I have never found it living in a hollow tree, although it may do so occasionally. The nests of pine or spruce needles and fine strips of bark are usually constructed in the fork of a branch well out from the main trunk, at from twenty to forty feet above the ground, and in the densest forest. I have found the nests occupied by the Squirrels in both summer and winter. This Squirrel is not at all shy, and may be coaxed to within a few feet by making a non-descript, 'screaping' noise. One seen in August was laboriously ascending a tree, carrying a large cantaloupe rind, which had been left by a camper. In some localities it is called the little Gray Squirrel, which is, of course, a misnomer."

The Red Squirrel has many enemies, and of these the most deadly are the hawk, the owl, and the Weasel. The Weasel is the most relentless of all, and by his sense of smell pursues the Squirrel through the tree tops. The Squirrel is much fleeter, but for some reason not known, he seemingly goes crazy when he discovers the Weasel on his trail, and rushes pellmell among the tree tops, up and down, crossing and recrossing his trail, until at last, hiding among the branches or taking to a cavity, he awaits the coming of the Weasel, which means nothing less than sure death.

FOX SQUIRREL

Sciurus niger *Linnaeus*

General Description.— Largest of the North American arboreal Squirrels. Head large, blunt, rounded; ears of moderate height, rounded; body large, fairly heavy; tail about one-half total length, broad and bushy; legs short; pelage harsh; color varying from glossy black to clay color mingled with black.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{1-1}{1-1}$; Molars, $\frac{3-3}{3-3} = 20$.

Pelage.— Adults: Sexes similar. Seasonal variation not especially noticeable. General color above, from glossy black to clay color mingled with black; clay color below; tail mixed black and clay color; nose and ears always white; top of head usually black. Young: Colors not so strong as in adults.

Measurements.— Total length, 25.5 inches; tail vertebrae, 12 inches; hind foot, 3.5 inches.

Range.—Virginia to Florida, east to Alleghenies, and Gulf Coast to Louisiana.

Food.— Nuts and seeds of trees with some buds, fruit and berries.

Remarks.— The Fox Squirrels may be known from the other North American Tree Squirrels by their large size, heavier bodies and distinctive coloration. About five species and subspecies are known in the United States.

Related Species

Fox Squirrel, or Black Fox Squirrel.— *Sciurus niger niger* Linnaeus. Typical animal as described above. Florida and the southeastern States.

Yellow-bellied Fox Squirrel.— *Sciurus niger rufiventer* (Geoffroy). Smaller than the Black Fox Squirrel; ears and nose never white. Greater part of the Mississippi Valley from northern Louisiana to southern Wisconsin.

White-bellied Fox Squirrel.— *Sciurus niger neglectus* (Gray). Belly white or whitish. Central Virginia and West Virginia to Pennsylvania.

Texas Fox Squirrel.— *Sciurus niger texianus* (Bachman). Smaller and paler than the Western Fox Squirrel. Coast region of Louisiana and Mississippi.

The Fox Squirrels are big strapping fellows, the largest members of their large family in America. They are also the laziest. They can defend themselves more easily from some of their enemies such as the hawks, and for this reason may have lost some of their agility.

They prefer also to lie abed of a morning, snuggling contentedly between their mossy or leafy coverlets, rather than hustle abroad with some of their noisier red cousins. This, however, is not because they fear the cold, but from sheer laziness. Dr. Hornaday says: "In captivity the northern Fox Squirrel seems to be more hardy in winter than the Gray Squirrel.

By permission of the New York Zoological Society

FOX SQUIRREL

This species is the largest of the North American Tree Squirrels. It is most common in the Southeastern part of our country. Photograph one-third life size

In the New York Zoological Park it blithely runs about in the snow when the latter takes pains to avoid it. Often the Fox Squirrel will be out when none of the other occupants of the rodents' cages are visible. It seems to me, however, that the Fox Squirrels are not as nimble on foot, or as active and daring in the tree-tops, as the Gray Squirrels."

Mr. Witmer Stone says of the southern species which is the more common type: "In rough weather they keep close at home in their hollow trees, choosing to go hungry rather than face the cold. In warm weather they gather wild fruit, berries and mushrooms and go into the corn fields as soon as the ears have reached the milky stage. Among the southern pines they make large nests of Spanish moss in the tree-tops, and here they bring the cones which they cut off, just as the Red Squirrels do the cones of the white pines in the North, biting off the scales in order to get at the seeds in a similar manner. The scales scattered about the foot of their tree often betray them to the Squirrel-hunter. They are much hunted as an article of food, being well flavored and heavy, but it requires skillful watching to kill many of them."

The Fox Squirrel's home is chiefly in the southeastern and gulf States. It is found as far west as Louisiana, and one species, the Yellow-bellied, along the Mississippi Valley as far north as Wisconsin. An observer in Colorado states that a few have been introduced there from the East, but thus far have not increased to any appreciable numbers.

Photograph by Dr. R. W. Shufeldt

FOX SQUIRREL

The Fox Squirrels, which are found chiefly in the Southern States, are the largest members of the tribe in America

TUFT-EARED SQUIRREL

Sciurus aberti *Woodhouse*

Other Name.— Abert's Squirrel.

General Description.— A large tree Squirrel about the size of the Eastern Gray and resembling it somewhat in color. Head blunt and rounded; ears tall and noticeably tufted, especially in winter; body large; tail less than half the total length, broad and bushy; feet of moderate length; pelage full and moderately soft. Only three subspecies are known.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3} = 22$.

Pelage.— Adults: Sexes identical. *Summer.* Above plumbeous gray with broad dorsal area of reddish-brown; under surface, including tail, pure white; sides with a black line between gray of upper surface and white of underparts; tail black at tip, mixed gray and black above, white beneath; ears with conspicuous tufts. *Winter.* General coloration much as in summer but ears clothed with chestnut hair at base and tufted with blackish hairs more than an inch in length. Young: Similar to adults.

Measurements.— Total length, 20.2 inches; tail vertebrae, 8.9 inches; hind foot, 2.5 inches; ear from crown, 1.5 inches; length of ear tufts in winter, 1.5 inches.

Range.— Pine-covered plateaus and mountains of northeastern Arizona eastward into New Mexico.

Food.— Pine nuts, acorns, ground nuts and green vegetation.

Although closely resembling the Eastern Gray Squirrel, in some respects, the Tuft-eared Squirrel deserves separate consideration, as in many ways it is nearer the typical Tree Squirrel of the Old World, *Sciurus vulgaris,* from which it differs only in color and in several minor characters. Its Old World relationships are indicated in the long ear-tufts found developed to such a degree in no other North American Squirrel. These ear-tufts are sufficient to distinguish this animal at once from the Eastern Gray.

The Tuft-eared Squirrel is characteristic of the stately yellow pine forests, and in the open vistas can be seen at a considerable distance. It is often first detected on the ground, moving about among pine cones which carpet the forest floor in many places. When alarmed, it lopes leisurely up to the base of a pine, usually the nest tree, which it seems reluctant to climb, barking and scolding at the intruder until approached somewhat closely. When thoroughly frightened it betakes itself to the higher branches and its claws make a very audible sound on the dry bark. When seated motionless on an exposed limb far up in a big pine, it presents an odd appearance, due to its long hairy eartufts. Once safely within the confines of the nest tree it will occasionally scamper part way down the trunk in a daring fashion, chattering excitedly. In climbing up or down a tree it spreads its feet far apart and by its flat appearance reminds one strongly of a Flying Squirrel.

The nest tree — usually a large dead pine with a hollow sufficiently large for the Squirrel's home — is generally located in the heaviest forest, and very few of the animals live in small timber or along the outskirts of the forest. A few nests, composed largely of dry pine needles, have been seen in the upper branches of large pines, but most of the Squirrels appear to be living in hollow trees. A stomach examined contained a mass of finely masticated green material which could not be identified with certainty, but probably consisted of the inner bark of the terminal branches of the yellow pine. One Squirrel was seen gnawing the bark from a good-sized limb, apparently feeding. The many freshly cut tips of branches beneath the pines in the neighborhood of the nest trees also attest to the Squirrels' activities.

In the silence of the vast forest reaches, the calls of this Squirrel are at times the only sounds which reach the ear. During rainy or inclement weather, however, the Squirrels are inactive and the calls rarely heard. The soft bark, sometimes sounding like "wuh, wuh, wuh," and again like "chuck, chuck, chuck," is usually repeated three or four times at short intervals, and each call is accompanied by a jerk of the tail. These Squirrels are occasionally kept in confinement and are said to make desirable pets.

RICHARDSON'S SQUIRREL

A handsome species of the West. This one was "snapped" running down a tree, near Old Faithful Inn, Yellowstone Park

EASTERN FLYING SQUIRREL

Sciuropterus volans (*Linnaeus*)

General Description.— A small, soft-haired arboreal Squirrel. Head blunt and rounded; ears low and broad; hair on ears very short; body small; tail about as long as head and body, broad and flat; an extension of skin from the sides of the body reaching from wrist to ankle forming when the legs are spread, a flat plane; legs of moderate length; hair very soft and of moderate length; eyes large and soft; general color above grayish-brown, below white; hairs on tail very soft, and while tail is broad it is not bushy. Nocturnal in habit.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3} = 22$.

Pelage.— Adults: Sexes identical. *Summer.* Upper parts grayish-brown washed with rusty-brown, becoming deeper on upper surface of tail; upper portion of lateral membrane dark drab brown; below white, the hairs entirely white to the bases; under surface of tail tawny to tawny-white. *Winter.* Similar to summer, but upper parts tinged with grayish-brown. Young: Mouse-gray above.

Measurements.— Total length, 9.3 inches; tail vertebrae, 4 inches; hind foot, 1.22 inches.

Range.— Northern New York and southern New Hampshire south to Florida, west to the Plains.

Food.— Omnivorous to a considerable extent; nuts, seeds, insects, birds' eggs and occasionally young birds.

Related Species

Eastern Flying Squirrel.— *Sciuropterus volans volans* (Linnaeus). Typical animal as described above. Northern New York, southern New Hampshire to Florida, west to the Plains.

Florida Flying Squirrel.— *Sciuropterus volans querceti* Bangs. Underparts washed with rusty. Florida to southern Georgia, west to Louisiana.

Northern Flying Squirrel.— *Sciuropterus sabrinus sabrinus* (Shaw). Decidedly larger than Eastern Flying Squirrel; fur of underparts gray at base instead of all white. Boreal North America south to northern New York and southern New Hampshire.

Alpine Flying Squirrel.— *Sciuropterus alpinus alpinus* (Richardson). Larger than Northern Flying Squirrel with longer tail; above yellowish-brown. From MacKenzie River along east side of Rocky Mountains to northern border of the United States.

Cascade Flying Squirrel.— *Sciuropterus alpinus fuliginosus* Rhoads. Similar to Alpine Flying Squirrel in size, but color darker. Cascade coast and Sierra Nevada Mountains at high elevations.

Olympic Flying Squirrel.— *Sciuropterus alpinus olympicus* Elliot. Largest of the Flying Squirrels. Color dark. Total length 13.5 inches. Northwestern Washington in Olympic Mountains.

The Flying Squirrel is a very specialized animal and stands in a group well differentiated from the other North American Squirrels. Its so-called flying membrane at once marks it out from the other Squirrels, and in addition the texture of the pelage is very much softer, the individual hairs being rather long, very lax and exceedingly soft to the touch. The lateral membrane is supported mainly by the limbs, but in addition a cartilaginous spur or slender rod runs backward for a short distance from the wrist, and serves to stiffen the forward edge of this gliding plane. A number of Flying Squirrels have been described, some eighteen species and sub-species in all, and while the differences between many of these varieties appear slight, there are several well-marked groups best singled out on the basis of size difference.

The Flying Squirrel is a specialized member of his family, possessing a peculiar, hair-covered membrane of skin on each side of the body, between the fore and hind legs, and attached to both as far as the wrist and the ankle. When the Squirrel is about to "fly" it spreads its "wings," and from the summit of a tree springs into the air and then glides swiftly on an inclined air-plane, always in a slightly descending direction, until a movement, probably of both body and tail, inclines it upward, and it alights gently upon the object for which it set out. The tail, being thin and flat, with closely set silken hairs, probably serves a double purpose on these short "flights" — that of rudder and parachute. I do not mean by this that the tail can in any way turn the animal from a straight line, except that probably by bending it downward, and at the same time elevating the head, it brings the body in a convenient position for alighting upon an upright object. The distance that the Squirrel can "fly" depends entirely upon the elevation from which it starts. The angle of descent is ordinarily from twenty to thirty degrees, although the desire of the animal and the direction and force of the wind probably command an extreme range of from forty or fifty degrees to a nearly perpendicular drop. The powerful hind legs of the Flying Squirrel are important factors at the beginning of the "flight," for by means of these it is projected into the air with considerable force. The usual mode of travel from place to place, if trees are convenient, is sailing from the top of one to the base of

another, then running up this and again sailing. It is surprising how quickly one of these little fellows can travel a quarter of a mile.

The Flying Squirrel is one of the most beautiful and graceful, and by far the most gentle of our Squirrels, becoming quite tame in a few days.

On one occasion a Flying Squirrel mother and four young ones were taken from a hollow tree. She seemed very willing to remain with them, and so the family was taken home in the pocket of a coat. They were placed in a box near a window, which was left partly open. At first the mother remained with the young only at night, but in a few days she had gained sufficient confidence to remain with them the whole day, and even allowed herself to be handled.

This was not an unusual instance of gentleness, for several years ago the writer knew a man to capture two adult Flying Squirrels, a male and a female, who took them home for pets. In a short time they were very tame, and at nightfall they would come from their cage and play about the house as contentedly as though they were in their forest home. In the spring comfortable quarters were made for the Squirrels in the woodhouse attic. At the rear of the attic stood a large maple tree, the boughs of which touched the woodhouse. The old tree had but one cavity, but it was supplemented by a woodpecker stub and fastened in an upright position about thirty feet from the ground. It did not take the Squirrels long to find an opening at the end of the attic by the old tree, and so their playground was considerably enlarged.

In the old stub the first litter was born, and as soon as the young ones were large enough to enjoy night frolics, the attic became their playhouse.

The distance from the old tree to the edge of the forest, where nuts were plentiful, was only a few rods, and even this was made easy for the Squirrels by the use of a fence and orchard. By the time the nuts were ripe the old instinct had conquered the few months of civilizing influences, and the whole family must have visited the forest nightly, judging by the quantity of nuts that were stored in boxes in the attic and in the stub of the old tree. The family lived together that winter, but the next spring most of the young ones sought homes of their own, probably in the forest near by. Other young were reared in the attic and the old tree, but the following August they all mysteriously disappeared, both old and young, probably obeying some migratory instinct. It is worthy of note that the autumn following their disappearance the nut crop was nearly a failure in that immediate vicinity. Could there be any connection between the two circumstances?

Concerning the degree of intelligence of the Flying Squirrel, we quote from Charles C.

Photograph from the American Museum of Natural History

FLYING SQUIRREL

This specimen was mounted, but the attitude in taking its flying leap is very lifelike

Abbott: "Years of familiar acquaintance with these Squirrels have not enabled me to detect much in their habits indicative of intelligence; and it is for this principally that I look in studying animal life. I feel sorry to have so poor an account to give of these beautiful creatures, but I am compelled to say it of them — they are not 'smart.' Notwithstanding all their vivacity when in their native haunts, and their eminently gregarious habits, they do not suggest by any of

their movements, so far as I could ever detect, any decided indication of that sociability characteristic of the Ground Squirrels, or Chipmunks. Each, on the contrary, jumps, runs, flies, solely on his own account, associated together indeed, but never acting in concert. Their several squeaky cries, too, are quite as frequent when they are alone as when associated with their fellows."

If one really wishes to know the Flying Squirrel, the best plan is to go into a large grove of maples, beeches, and chestnuts on a still moonlight evening in early autumn, find a comfortable seat and remain quiet. If it so happens that one does not see a Flying Squirrel, one will be amply repaid, for other night-loving animals are abroad, and they are as interesting as those seen by day. One must be patient, look, and listen! The night hawk is already on the wing, and the bat has taken the place of the chimney swift. Then comes a sound like that of a nut dropping from a tree. A slight rustle among the leaves is heard overhead, as a shadowy form glides through the air, and alights upon the bole of a tree; another soon follows and alights at nearly the same place and hastens after the first. It is quite common for three of four Flying Squirrels to start from the same or neighboring trees, and at times there will be various lines of them crossing and recrossing one another.

The writer cannot quite agree with Mr. Abbott concerning the play of the Flying Squirrels. As far as I can judge, frolic and amusement occupy the greater part of the waking hours, and old and young seem to enjoy it alike. Even during the "business hours," when the storehouses must be filled with nuts for winter use, the same rollicking spirit holds sway over this Squirrel band.

The Flying Squirrels, unlike most others, live in communities, but during the winter a dozen or even more may occupy the same cavity in a hollow tree. Even in the storing of food for winter, several may unite in gathering a general supply. The storehouse may be in the same cavity as the living quarters, or in a separate one in the same tree, while it is occasionally in a tree some little distance away. The food stored consists of nuts and seeds of various kinds; but in season, buds and fruits are much enjoyed.

Wood-choppers very often find the storehouses of the Flying Squirrels. One man took six quarts of beechnuts from a cavity in a large maple tree in the month of January, and from the same tree counted eight escaping Flying Squirrels. In this instance the Squirrels and nuts were found in separate cavities.

Flying Squirrels make large nests of leaves in tall trees, which are similar to those of the Gray Squirrel. These nests are sufficiently compact to withstand the storms of winter, and warm enough to protect the Squirrels during cold weather. I have never known these nests to contain food for winter use. It may be that they are used principally as summer homes.

The Flying Squirrel during the day avoids the light, its large eyes, like those of the owl, being better adapted to darkness, and so one may get the idea that it is a dull and uninteresting pet, crawling into your sleeve or pocket and seeking any dark place of concealment. When asleep it is so rolled up as to appear like a ball of fur, the head resting near the base of the tail, which is spread over the body, doing duty as pillow and coverlet. S. A. Lottridge.

GREAT PLAINS GROUND SQUIRREL

Citellus elegans *(Kennicott)*

Other Names.— Great Plains Spermophile, Wyoming Spermophile.

General Description.— The Great Plains Ground Squirrel may be taken as characteristic of a very large group of Ground Squirrels found all over western North America. It is of rather small size. Head blunt; ears broad, rounded, of moderate height; white eye ring; tail fairly bushy, nearly half length of head and body; body elongate but not slender; legs short; general color brown above; below dull yellowish-white.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3}=22$.

Pelage.— Adults: Sexes identical, seasonal variation not conspicuous. Upper parts brown, mottled indistinctly, black tips to hairs; top of head like back but without black tips to hairs; sides, flanks and upper surface of feet pale fulvous; under parts a paler shade of fulvous; chin whitish; whitish buff ring about eye; tail above, mixed brown and black, tip black edged

with whitish, tail below, brown or fulvous with black tip. YOUNG: Colors paler.

Measurements.— Total length, 10.8 inches; tail vertebrae, 3 inches; hind foot, 1.7 inches.

Range.— Wyoming, Colorado and Utah in the Plains region and up into foot hills.

Food.— Grasses, seeds, grain and some insect food.

RELATED SPECIES

Great Plains Ground Squirrel.— *Citellus elegans* (Kennicott). The typical animal of the above description. Wyoming, Colorado and Utah.

Richardson's Ground Squirrel.— *Citellus richardsonii* (Sabine). About the same size as the Great Plains Ground Squirrel, coloration yellower. From Saskatchewan, latitude 55° N. south to South Dakota and Montana.

Townsend's Ground Squirrel.— *Citellus townsendii* (Bachman). Small; tail short, not very bushy; colors dark. Nebraska westward to plains of Columbia river, and from Wyoming and Utah to Montana, Idaho and Oregon.

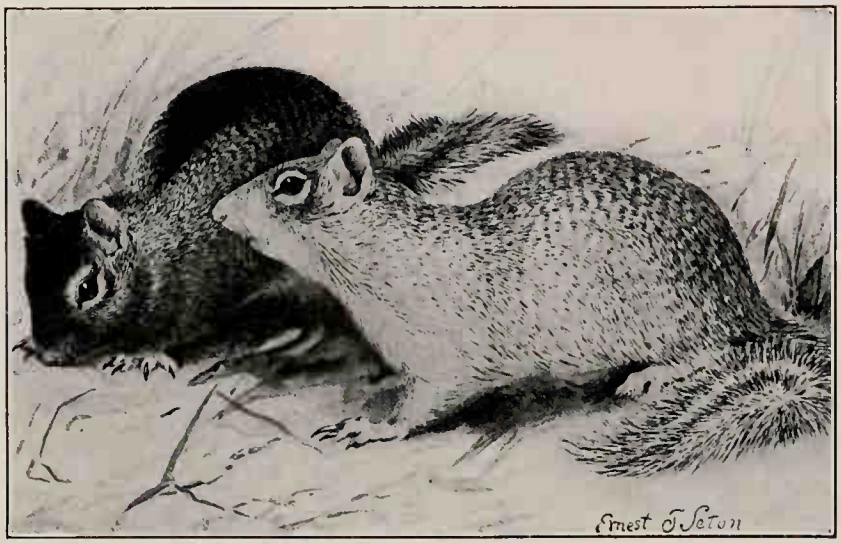
Soft-haired Spermophile.— *Citellus mollis mollis* (Kennicott). Size very small; ears small; silvery gray above; fur very soft. Utah and Nevada.

Picket-pin "Gopher"—*Citellus armatus* (Kennicott) Body stout; ears large; tail short and moderately bushy; pelage soft; color above dark gray and black; length 10 inches. Utah, Wyoming, Idaho and Montana.

Spotted Spermophile.— *Citellus spilosoma spilosoma* (Bennett). Size small; form slender; length 10 inches; tail about 2.25 inches; above, rusty brownish spotted with ill-defined white spots. Southern California to New Mexico and Texas.

Round-tailed Spermophile.— *Citellus tereticaudus* (Baird). Size small; tail not bushy, and about four-fifths length of head and body; grizzled grayish-brown above; beneath brownish-white; length 10 inches. Central California to southern Arizona.

Franklin's Spermophile.— *Citellus franklinii* (Sabine). Similar in build to Thirteen-striped Ground Squirrel, but lacking the stripes; color grayish-brown. From Saskatchewan south to Nebraska, Kansas and Missouri, eastward to Indiana.



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GROUND SQUIRRELS

Points of difference between the Douglas and the California Spermophiles are shown in the above drawing by E. T. Seton

Spermophile is a word literally meaning "seed lover," and has been given to a large group of Burrowing or Ground Squirrels, as it most nearly describes their chief characteristic. They are indeed seed-lovers, as the farmers in the West know to their sorrow; for this small animal causes the annual loss of large crops through destruction of the seed grain.

The Spermophile is a Ground Squirrel which in some of its species resembles the tree Squirrel, on the one side, and the Chipmunk on the other. Its burrowing traits ally it to the Marmot. It is frequently called a "Gopher" in the Middle West, but this is a misnomer. The only true Gophers in America are the Pocket Gophers, described elsewhere.

Ground Squirrels are found in the greatest numbers on the great plains of the West. Because of the scarcity of trees they have doubtless lost their tree-climbing propensities, and they

prefer to dig deep tunnels underground, in which they fix up very cosy quarters. They always seek and prefer the open country.

Crevices in rocks, and burrows similar to those of Chipmunks, but larger, serve as homes for the Ground Squirrels of the plains. Sometimes the mound at the mouth of the burrow is several inches high, but frequently it has been so beaten down that there is scarcely any elevation at all, but just a bare spot of earth a yard in diameter. Often the mouth of a tunnel is under a root, the base of a tree, or the lower edge of a boulder, and little or no dirt is scattered about to indicate its presence. Always, however, the surrounding area for three feet or more is kept bare, smooth and hard by the constant trampling of little feet.

These Spermophiles spend hours at a time sitting or lying near the mouth of the burrow, and rarely stray farther away than one hundred yards. As a class, they are gregarious animals, but the Picket-pin "Gopher" is much less so than many of the others. Their burrows may be scattered along a road for miles, all of them several rods apart. In wide areas of open grassy country, small colonies may be established. In Wyoming, and in Colorado, the writer has seen a few groups of ten or a dozen homes each. Not more than half an acre was occupied in any case. About camp sites they are particularly numerous. These little animals make an interesting group to watch, after a hard day in the saddle, as they scurry about in search of waste grain and camp refuse. The writer has never seen a Spermophile in a dense forest or at a greater altitude than 8500 or 9000 feet. In northern Wyoming their lowest altitude seems to be about 5000 feet.

Like the Chipmunks, the Spermophile's food is largely vegetable matter made up of seeds and grasses, but it will not scorn animal food such as grasshoppers and other insects. In former days dead Bison were said to be favored as food. They will attack growing grain, and store the ripened grain in their underground chambers.

From early fall until early or late spring, according to the latitude, the Spermophile is dead to the world, but, be the ground bare or snow-covered, it appears at about the same time in the spring in any given locality.

As soon as hibernation is over the raising of a family occupies its attention. Four to six young to a litter appear in middle or late May in Colorado.

Small rodents seem to exist to furnish food for the birds of prey and carnivorous animals large and small. To the Bear, the Coyote and the Weasel, they are all acceptable, and the Ground Squirrel is no exception to the rule.

Mr. Merritt Cary, in "A Biological Survey of Colorado," says: "The sage flats in Middle and North parks are densely populated with these Ground Squirrels, and ranchmen consider them very injurious to the cattle range and to small grain. Judging from my own observations the damage inflicted is by no means slight, and when the large territory inhabited by them is considered, it must be very considerable. During July I often saw numbers in the rye fields eating the green stalks, and not a vestige of grass remained near their burrows. Ranchmen in the Snake River Valley claim that this species destroys fully a third of the rye crop, pulling down the stalks to get at the heads. In North Park I often saw them in the hay meadows, whither they resort in the early morning, busily engaged in pulling down and eating the tall grass stems. This species hibernates very early in the autumn."

Close acquaintance with the *Picket-pin "Gopher"* in the western plains shows how well it deserves its name. Curiosity seems to require that it sees as much as possible of every strange object. At first it stands up in a bent position like a Tree Squirrel, then straightens up, and finally fairly raises itself on its hind legs, stretches to its full height, and gazes with all its might with its twinkling, bright black eyes. When in this position, with its arms partly folded at its sides, the diameter of its body seems to be about the same throughout, and the term "Picket-pin" is the most apt that could be applied, especially in a region where horses are often tethered. A close or a sudden approach will send the animal scurrying to its burrow with a sharp, trilling whistling resembling that of a Chipmunk. In a moment, if you look down into the hole, you will see its head appear in the blackness. Stand still, and the little fellow will soon move out with short starts and jerks. If you move backwards a few yards, it will presently be looking at you in the regular picket-pin style. Attracted by curiosity perhaps two or three more from the same opening will join the first.

Richardson's Spermophile is a northern neighbor of the Great Plains species. It is about the same size, but of more yellowish hue, so that it is hard to distinguish from the surface

of the ground, especially in autumn. It is found as far north as Saskatchewan, and is reported to be far more destructive to the grain fields than its southern relative. This species has a short, thin body, squat legs, and a short thin tail. It looks very much like an underfed Prairie Dog.

The *Spotted Spermophile* is a little Ground Squirrel which prefers the deserts or the dry levels of the plains and the eastern border of the Rocky Mountain region. In the desert the mouths of its burrows often open under yuccas. Shy, quiet, small and prettily marked, these animals are in strong contrast to the big, noisy plain-colored species, such as the Bushy-tailed Spermophile. Under favorable conditions they increase almost as rapidly as rabbits. There may be as many as eight young to a litter.

Franklin's Spermophile is one of the more common varieties. It is found in the middle West, from Indiana to Missouri and Nebraska, and extending north into Canada. This animal has very similar habits to Richardson's Spermophile, and like it is interesting in being a connecting link. But while the latter seems nearest related to the Marmots, Franklin's Spermophile strongly resembles the Tree Squirrel. In many localities it called the "Gray Ground Squirrel."

When they become numerous near farms they are troublesome, venturing boldly into the barns and granaries; but the harm they do is offset to some extent by the insects they devour.

Photograph by J. M. Johnson, copyright by Outing

"PICKET-PIN GOPHER"

A name bestowed upon this gray Spermophile, in the Middle West, from the fact that a row of them will stand so erect and still as easily to be mistaken for picket-pins

In the Department of Agriculture, twenty-nine stomachs were examined with the following result: Animal matter present, 30.3 per cent.; vegetable, 68.5 per cent.; and undetermined, 1.2 per cent. Out of the whole twenty-nine stomachs examined, twenty-six contained the remains of insects. Thus the grain consumed by this animal is at least partially paid for by the destruction of insects that prey upon crops; but farmers everywhere are diligent in destroying it with poisoned wheat placed in its burrow.

J. M. Johnson.

COLUMBIA GROUND SQUIRREL

Citellus columbianus (*Ord*)

General Description.— A large, heavy-bodied, short-tailed Ground Squirrel. Head very blunt; ears broad, rounded, of moderate height; body very thick-set; tail only about one-quarter length of head and body, flat and moderately bushy; legs short; color above, mixed white, black and yellowish-brown; below, brownish-red; hairs of moderate length and coarseness.

Dental Formula.— Same as foregoing.

Pelage.— ADULTS: Sexes identical; some seasonal variation but not especially conspicuous. Color above, mixed white, black and yellowish-brown with numerous blotches formed by the white; an obscure brownish streak on back; upper part of neck blackish; side of face grizzled black and white; under parts and hind parts of hips and thighs brownish-red; feet like under parts; tail above gray, brown and black mingled; beneath, brownish-red bordered with black. YOUNG: Like adults but colors paler.

Measurements.— Total length, 15 inches; tail vertebrae, 3.5 inches; hind foot, 1.8 inches.

Range.— From western Montana to Washington, and north through British Columbia and Alaska to Plover Bay in Siberia.

Food.— A variety of fleshy plants, seeds and roots.

Remarks.— This Ground Squirrel is an example of the group of heavy-bodied, short-tailed Ground Squirrels that range throughout the Northwest. They are all large animals. Some thirteen of the larger species have been described, if for convenience sake we form a group, although they are closely related to the smaller Ground Squirrels of a more southern range.

RELATED SPECIES

Columbia Ground Squirrel.— *Citellus columbianus columbianus* (Ord). Typical animal of the above description. From Montana north to Alaska.

Point Barrow Ground Squirrel.— *Citellus barrowensis* (Merriam). Largest Ground Squirrel known. Region about Point Barrow, Alaska.

Alaska Ground Squirrel.— *Citellus beringensis* (Merriam). General color fulvous; ferruginous on nose and underside of tail; back spotted with buffy white; size large. Common to the region about Cape Lisbourne, Alaska.

Yukon Ground Squirrel.— *Citellus osgoodi* (Merriam). Size large; tail long; gray above with fulvous flanks; back fulvous spotted with whitish; under parts ferruginous. Yukon region, Alaska.

Arctic Ground Squirrel.— *Citellus parryii* (Richardson). One of the largest and hardiest; tail short. Mixed black, white and yellowish-brown above, top of head cinnamon and black. Arctic America from Melville Peninsula to southwest Yukon River, and in the east to 65° north latitude.

Photograph by the U. S. Biological Survey

COLUMBIA GROUND SQUIRREL

A very large Spermophile that is fond of roots and tubers, and hibernates for long periods

The group of Ground Squirrels typified by the Columbian is found in the extreme Northwest, reaching through British Columbia up to and across Alaska, and as far west as Siberia. The animal resembles its southern cousins in many respects, except that it is about half as large again as the usual type. It is the size of a large cat, with heavy body, short tail, and thick fur.

On account of its bleak environment, some change also is noted in its habits. It greedily eats roots and tubers and usually prefers a snug hole in the rocks to digging very far down in the hard soil. The animal is sluggish in its actions, and falls an easy prey to its enemies including man. This is, in fact, one of the few Spermophiles that men eat. Its flesh is said to be well-flavored.

From four to six months in the year it hibernates, this long period being necessary on account of the length of winter. One animal was examined during this sleep, and it was found that the heart action was reduced to four faint beats per minute, the temperature was only fifty-eight degrees, and there was no visible breathing. The circulation of the blood was so feeble that when a limb was amputated, only a few drops of blood slowly oozed from the wound while the nerves showed no sensitiveness. In fact, the animal was in a condition of suspended animation, as if under the influence of chloroform.

BUSHY-TAILED GROUND SQUIRREL

Citellus grammurus (*Say*)

Other Names.— Rock Squirrel, Gray Digger, Scrub Gopher, Spermophile.

General Description.— A large, long-tailed, full-bodied Ground Squirrel. Head blunt; ears of moderate height; body not excessively heavy; tail very long, nearly half of total length and quite bushy, flat; legs of moderate length; soles of feet smooth; general coloration drab or sepia, thickly sprinkled with small whitish spots; hairs fairly long and coarse.

Dental Formula.— Same as foregoing.

Pelage.— Adults: Sexes identical, seasonal variation not conspicuous. Back and sides thickly sprinkled with indistinct, small, whitish or pale brown spots of sepia on drab ground color. Color below, brownish-white or grayish; tail grizzled brown with hairs annulated, under surface grayer than upper surface. Young: Paler in color with distinct white neck patches; spotting dimmer than on adults.

Measurements.— Length, 20 inches; tail vertebrae, 8.5 inches; hind foot, 2.2 inches.

Range.— Park region of the Rockies from Central Colorado south to Mexico.

Food.— A number of plants and their seeds and probably some insect food.

Related Species

Bushy-tailed Ground Squirrel.— *Citellus grammurus grammurus* (Say). The typical animal of the above description. From Central Colorado south to Mexico in park region of the Rockies.

California Ground Squirrel.— *Citellus grammurus beecheyi* (Richardson). Smaller than the typical form with body more slender and tail shorter. West of the Sierra Nevada in California.

Texas Rock Squirrel.— *Citellus grammurus buckleyi* (Slack). Like the Bushy-tailed Ground Squirrel in size and form, but with anterior half of the dorsal surface black and hairs elsewhere much blacker. Middle Texas to western Texas.

Douglas's Bushy-tailed Ground Squirrel.— *Citellus grammurus douglasii* (Richardson). Size intermediate; shoulder patches black. Northern California and Oregon.

Fisher's Bushy-tailed Ground Squirrel.— *Citellus grammurus fisheri* (Merriam). Similar to the Bushy-tailed Ground Squirrel, but sides of neck and shoulder stripes heavier white. Western border of Nevada, central and southern California.

The group of Ground Squirrels which the Bushy-tailed Ground Squirrel typifies, resembles, perhaps more closely than any others of the family, the large Gray Squirrels of the trees. The Bushy-tailed has the largest and bushiest tail of all the Ground Squirrels and its general appearance is very similar to that of the true Gray Squirrels, *Sciurus,* but it may be distinguished from the latter by its mottled appearance and the fact that it sticks pretty closely to mother earth. Seven subspecies of this form are recognized north of the Rio Grande, all very similar in most characteristics.

The Bushy-tailed Ground Squirrel or "Scrub Gopher," as it is sometimes called, differs only slightly in habits from the Striped Spermophile,

and the Picket-pin Gopher. It prefers a more wooded country than the former, and a less elevated region than the latter. It likes a brushy, rough territory, with a few trees here and there. In fact, this animal seems to occupy the same position in the Rocky Mountains that the Picket-pin Gopher does in the prairie country.

Photograph by W. P. Dando

HARRIS ANTELOPE GROUND SQUIRREL

An inhabitant of the southwest

The burrow is similar to that of the Striped Spermophile, but is likely to be dug into the side of a brush-covered bank, and it is farther below the surface.

After hibernating, this animal appears later in the spring than other species of the same region. About May first is the time it is first to be seen. Mating soon begins, and the four to seven young are born about a month later.

Although not so fiercely carnivorous as the striped form, the Bushy-tailed Spermophile will eat flesh whenever it can find it. Vegetable matter, however, furnishes its main food supply. Unlike some other species, it requires a supply of water to drink. Some Ground Squirrels live in arid wastes and seem to get enough moisture from their food.

In early October, the "Scrub-Gopher" makes itself safe against unfavorable weather and enemies by plugging up the various entrances to its home with earth, and enters into its night of six months.

Merritt Cary, who recently made an extended study of these animals in the West, says: "Rock Squirrels nearly always live in rocky mountains, the ledged and boulder-strewn sides of canyons, the bare rocky slopes along the base of the foothills, and the rim rock of outlying mesas and buttes being especially frequented. In the pinyon country their burrows are often found along the margins of fields in a nearly level country. As a rule, however, the burrows are located beneath boulders at the base of a rocky canyon rim or in rock slides. Rock Squirrels are quite shy and wary, and when one is surprised in the bottom of a canyon, as is often the case, it invariably runs up the slope and takes refuge among the rocks above. If the observer remains perfectly quiet, he may at length detect the animal peering silently over the top of a large boulder, but it generally vanishes at the slightest noise or motion. I watched one of these Squirrels dusting itself near Bayfield. Apparently it was unaware of my presence and at intervals would run to a dusty spot in a path, throw the dust up with its fore feet, turn on its back, and wriggle and squirm along the ground in the greatest enjoyment. This performance was repeated a number of times when suddenly the little fellow spied me and raced off through the brush.

"While at Ashbaugh's ranch in June, I often heard the sharp alarm notes of Rock Squirrels in the orchard back of the house. Near Coventry in July they were feeding extensively upon pinyon nuts. In Grand Valley, near Glenwood Springs, in October, numbers were seen in the tops of large pinyons busily feasting upon the nuts, and so common is this habit in that section that the animals are locally known as gray tree Squirrels.

"The food of Rock Squirrels consists of pinyon nuts, acorns, and juniper berries, and consequently over much of their range the animals do little damage. In some sections, however, they are reputed to show a fondness for young chickens. They destroy many apricots on the trees for the sake of the seeds, of which they are especially fond; they eat holes in canteloupes and watermelons on the vines in search of the seeds, which they carry into the rocks to be eaten at leisure; and they also dig up and eat much newly planted corn."

THIRTEEN-STRIPED GROUND SQUIRREL

Citellus tridecemlineatus *(Mitchill)*

Other Names.— Striped Gopher, Striped Prairie Squirrel, Spermophile.

General Description.— A small animal with body rather slender for a Ground Squirrel but more robust proportionally than the Chipmunk. Head rounded; ears low, rounded, inconspicuous; tail somewhat bushy but flat, and about one-half length of head and body; legs short; fur short and rather glossy, the hairs being somewhat hard and shining; color pattern unique, consisting of 13 stripes along the back; underparts pale tawny brown; eyes black.

Dental Formula.— Same as foregoing.

Pelage.— ADULTS: Sexes identical and no seasonal variation in the color pattern. Above, back lined with 13 longitudinal stripes from ears to tail as follows: 7 long stripes of dull yellowish-white, alternating with 6 more or less broken rows of spots similar in color to stripes; stripes broken up on crown and haunches; rest of upper parts dark brown; belly dull buffy or tawny, nearly white on chin; tail yellowish-brown or sienna, fringed with black hairs yellowish tipped. YOUNG: Striped like adults but color paler.

Measurements.— Total length, 11 inches; tail vertebrae, 3.5 inches; hind foot, 1.4 inches.

Range.— Central North America from eastern Michigan to Montana, Colorado, central Texas, north to Saskatchewan Plains, and in prairie region of Mississippi from Ohio to Minnesota.

Food.— Seeds, grasses and also flesh.

RELATED SPECIES

Thirteen-striped Ground Squirrel.— *Citellus tridecemlineatus tridecemlineatus* (Mitchill). The typical animal of the above description. Central North America in the Prairie region.

Pallid Thirteen-striped Ground Squirrel.— *Citellus tridecemlineatus pallidus* (Allen). Size small, colors paler, light stripes white and wide. Wyoming, south to Texas and east to Missouri on the plains and desert regions.

Little Thirteen-striped Ground Squirrel.— *Citellus tridecemlineatus parvus* (Allen). Smaller than the typical form. Utah and Wyoming.

This small Ground Squirrel, because of the peculiar striping on the back, is at once distinguishable from any of the other Spermophiles. It is a prairie animal living on the grassy plains and not found in the heavily wooded regions. There are seven subspecies of the Thirteen-striped Ground Squirrel, all having the same essential pattern on the back and differing only in cranial characters or intensity of color. Vernon Bailey in his report upon these animals says: "Throughout the prairies of the Mississippi Valley the Striped Spermophile is a familiar object as it darts through the grass to its hole or is seen standing upright on its hind feet, straight and motionless as a stick. With its short ears, smoothly rounded head, and the fore feet drooping at its sides, there is no point about its outline to catch the eye, and at a little distance it is

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THIRTEEN-STRIPED SPERMOPHILE

This peculiarly marked Ground Squirrel is a Plains type, and is not found in heavily wooded sections

impossible to distinguish it from an old picket-pin or fence stake. Standing thus the animal will often allow one to approach within a few yards, then quickly dropping on all fours it utters a shrill chatter and dives into a hole close by. Remain quiet for a few minutes and its head reappears at the entrance of the hole, and the little black eyes peer at you curiously. Walk away from the place and it will soon come out and, standing up again, watch you as long as you are within sight, uttering an occasional note of alarm or warning to its friends."

Usually the Striped Spermophile is confined to the sagebush plains and the prairies, although it occasionally works up into altitudes of 9000 feet. This is also a form which shuns woodland of any greater density than that of a natural park. In the prairies of southern Canada, and of the Mississippi basin it is common although outnumbered by some other kinds, especially by the yellow or Richardson's Ground Squirrel. The settlement of these regions seems to be causing the decrease of the striped but not of the yellow species. One authority states that the very shallow burrows and chambers of the former are destroyed by plowing, and that the deeper ones of the latter are only temporarily plugged up. Since the burrows of the Striped Spermophile are only about six inches below the surface, plowing would not only destroy them, but the young as well.

The nesting burrow is complicated by many twistings, turnings and branchings. There are also several openings, some of which are occasionally stopped up. The real home room is about nine inches in diameter by six inches in height. In addition to this type of burrow, there is a simpler one, which may be used for temporary retreat from danger. To render the tunnel entrance inconspicuous, the excavated dirt is often scattered, and the opening hidden by a bunch of grass, weeds and other objects.

The Thirteen-striped Spermophile is apparently the most carnivorous of all this family. As much as 46 per cent. of its stomach contents has been found to be insects, caterpillars, grasshoppers, cocoons, insect eggs, birds, reptiles and mice. Offal of any kind of flesh is eagerly seized upon. Lacking other meat, it will eat its own relatives. For vegetable food, it uses the same materials as others, grain and seeds being the favorites. Food which will spoil is never stored. Extra food is laid by in side chambers made for the purpose. Since the animal is asleep all winter, this food must be used in the early spring when other food is scarce. This is just the time, too, when much food is needed. Because of their long fast the animals are thin, and the mating activities begin at once when they awaken.

In late May or early June, the young are born. The number varies from seven to fourteen, with nine the average. They are among the most helpless of young Ground Squirrels. Their eyes do not open at once, and twenty days are required for hair to appear on their naked bodies. By the end of summer, however, they are full grown.

The enemies of this species are the same as those of other Spermophiles. In many of the western States the larger hawks are protected by law, partly because of their fondness for Spermophiles and Prairie Dogs. Three and even five western red-tailed hawks may often be seen circling over colonies of these animals waiting for a favorable opportunity to swoop down upon one.

It is true that most Ground Squirrels take considerable grain, and may pull up newly planted seeds, but in the case of this species, the number of harmful insects and mice destroyed more than compensates for the damage done to the growing crops.

ANTELOPE GROUND SQUIRREL

Ammospermophilus leucurus (*Merriam*)

Other Name.— White-tailed Spermophile.

General Description.— Size small; head blunt and rounded; ears rounded and low; body moderately thickset; tail short, fairly bushy and flat, about one-third length of head and body, carried turned up over animal's back when running; hair moderately short; color above, grizzly gray with white stripe on either side of back; underparts glistening white.

Dental Formula.— Same as foregoing.

Pelage.— Adults: Sexes identical, seasonal variation not conspicuous. General color above, grizzled gray; vinaceous on head and rump with broad white

stripe on either side of back; outside of legs salmon color; underparts glistening white; tail above, iron gray with indistinct white border, beneath, white bordered with black. YOUNG: Much as adults but colors not so strong.

Measurements.— Total length, 8.5 inches; tail vertebrae, 2.8 inches; hind foot, 1.5 inches.

Range.— California and Utah to Arizona and New Mexico in arid regions.

Food.— A variety of different plants and their seeds.

Remarks.— The Antelope Ground Squirrel is representative of a group of 9 species and subspecies found north of the Rio Grande, all conforming rather closely to the same general type.

RELATED SPECIES

Antelope Ground Squirrel.— *Ammospermophilus leucurus leucurus* (Merriam). Typical animal as described above. California to New Mexico.

Cinnamon-Colored Antelope Ground Squirrel.— *Ammospermophilus leucurus cinnamomeus* (Merriam). Ears, tail and hind feet larger than in the Antelope Ground Squirrel, with color above pale cinnamon. Desert region of Colorado, Utah and Arizona.

Harris's Antelope Ground Squirrel.— *Ammospermophilus harrisii harrisii* (Audubon and Bachman). White stripe on sides narrow; color above, grizzled grayish-brown, and, in general, stronger coloration than the Antelope Ground Squirrel; tail lacking black dorsal stripe and not so white below. Southern Utah and Nevada into California, Arizona and northwest New Mexico.

Texas Antelope Ground Squirrel.— *Ammospermophilus interpres* (Merriam). As large as *leucurus*, but tail tinged with fulvous, and head grayer; pelage much finer and longer. Eastern desert tract of New Mexico and Texas.

Photograph by A. E. Butler — Courtesy of the American Museum of Natural History

SAY'S GROUND SQUIRREL

The Ground Squirrel may be readily distinguished from the smaller Chipmunk, by the fewer number of stripes on the former

The Antelope Ground Squirrel gets its name from the fact that the tail, with its glistening white under surface, is turned up over the back when the animal runs, and by this one feature it may be known from all the other Ground Squirrels. In addition it can be easily distinguished by a gray upper body contrasting with the pure white of the under parts. It is smaller than most of the Spermophiles, seldom exceeding five or six inches in body length.

Antelope Squirrels frequent sandy arroyos, and are striking objects as they frisk about in the morning sunshine with the pure white under surface of the upraised tail showing prominently. They are easily alarmed and retreat precipitately to the burrows, which are usually in the sandy bank of a dry desert wash or beneath sage or Atriplex bushes. In a few moments the animal may be watching the intruder from the mouth of a burrow or from behind a pile of rocks, but it

disappears at the slightest noise or movement. One which J. Alden Loring heard had a note described as "loud, shrill, and rattling, and gradually dying out like a policeman's whistle."

Mr. Loring states that the Antelope Squirrel has from four to six young in a litter. Ranchmen say that Antelope Squirrels do much damage in the spring by digging up newly planted corn. They appear to be particularly voracious and active at this season.

SAY'S GROUND SQUIRREL

Callospermophilus lateralis (*Say*)

Other Names.— Big Chipmunk, Spermophile.

General Description.— A small Ground Squirrel about twice the size of the Eastern Chipmunk and somewhat like it in appearance. Head rounded; ears of moderate size, broad and rounded, closely haired; body inclined to be thick set; tail about half the length of head and body, with long hairs arranged laterally to give a broad, flat appearance; legs in proportion to body; color in general, grizzled grayish-brown above, below brownish-gray.

Dental Formula.— Same as foregoing.

Pelage.— ADULTS: Sexes alike, seasonal variation from typical summer pelage as described below to grayer and more rusty in winter. Back, from shoulders to tail, a mixture of black, grayish-white and rufous; contrasting stripes formed by two black stripes inclosing a white stripe, along each side of back; flanks and sides of neck deep bright chestnut; top of head chestnut; upper surfaces of feet pale yellowish rusty color; a light ring about eye; below, light rufous with black bases to the hair; tail above, mixed black and chestnut with chestnut border, below, chestnut with poorly defined black border, the hairs tipped finely with chestnut again. Hair everywhere of short to moderate length and rather coarse than soft. YOUNG: Pattern as in adults, but colors not so strong and contrasting.

Measurements.— Sexes identical in size. Total length, 11 inches; tail vertebrae, 3.5 inches; hind foot, 1.65 inches.

Range.— Mountainous parts of Colorado, New Mexico and Arizona.

Food.— A great variety of seeds and various types of vegetation.

RELATED SPECIES

Say's Ground Squirrel.— *Callospermophilus lateralis lateralis* (Say). Typical animal as described above. Rocky Mountains in Colorado, New Mexico and Arizona.

Washington Yellow-headed Ground Squirrel.— *Callospermophilus lateralis saturatus* (Rhoads). Size large; tail very long; colors dark. Central Washington.

Yellow-headed Ground Squirrel.— *Callospermophilus cinerascens* (Merriam). General color grizzled ash-gray. Montana, Idaho northward into Alberta.

Golden-headed Ground Squirrel.— *Callospermophilus chrysodeirus chrysodeirus* (Merriam). Head and neck bright ochraceous; inner stripe as large as outer. Oregon, northern California and western Nevada.

Chestnut-tailed Ground Squirrel.— *Callospermophilus castanurus* (Merriam). Inner black stripe as large as outer; mantle chestnut; tail deep chestnut below, yellow above. Found in the Wasatch Mountains, Utah.

Say's Ground Squirrel is typical of a well circumscribed group showing relationship, on the one hand, to the small Chipmunks and, on the other, to the large Spermophiles or true Ground Squirrels. Say's Ground Squirrel and its related forms may be readily distinguished from the smaller Chipmunks by the reduced number of stripes, there being never more than two light stripes as against three or more on the Chipmunks. This group is of western distribution and contains some ten species and subspecies north of the Rio Grande. The range of variation is not very great in size, but in coloration runs from forms having a very strikingly contrasted pattern to others with the tones more subdued.

In addition to its proper name of Say's Spermophile this animal is called Say's Ground Squirrel, and Big Chipmunk. The Great Golden Spermophile is a closely related species found in the mountains of Wyoming. In habits and general appearance these two are so much alike that we shall consider them together.

In Yellowstone National Park, Wyoming, and in Estes Park, Colorado, Say's Spermophile fairly swarms, in suitable surroundings. It loves the open rocky situations, common in such places where it may be found from about 6000 feet up

to timberline. Although it likes the neighborhood of trees and shrubs, it is not a tree-climber; in fact it is rarely seen higher than the top of a stump.

Its favorite home is in crevices in the rocks, and in burrows which it digs. Seeds and acorns furnish most of its food, but it has been known to eat young birds and Meadow Mice. Around camps and houses it eats crumbs and almost any refuse. It tames very quickly, and will eat from a person's hand, climb up his clothing and into his pockets in search of food, much after the same fashion of our Gray Squirrels. In Yellowstone National Park, it is abundant about camp sites where it eats waste grain left by the horses.

Where there are buildings this Ground Squirrel becomes so common as to be a nuisance, as it makes its home nearby or in the buildings and attacks everything edible.

Four to six young are born in the spring or early summer. Until fairly mature they lack the rich cinnamon-brown of the throat and breast of the adult. This is true of the Wyoming species. The more southern species never attains the rich colorings of the northern.

Hibernation takes place in October and lasts until April. Sometimes the animal will burrow through deep snow to get to the surface.

Cheek pouches are greatly developed. Mr. E. R. Warren states that he has taken twenty-seven acorns of the scrub oak from the pouches of one individual. When fed liberally they will put nut after nut into their pouches until it seemed as if they must surely burst. The pouch contents are quickly carried away and hidden, and back the animals come for more. Sometimes they are so numerous about the person feeding them, that there is danger of treading upon them. Some get so fat, through getting so much food for so little work, that they can hardly waddle. In the sandy yellow pine country this Spermophile so constantly utilizes the tunnels of the Mountain Pocket Gopher, that it is continually getting into traps set for Gophers. It is fond of sunning itself in exposed situations during the warmer part of the day, and may often be seen sitting upright and motionless on a point of rock, tree stump, or ridge pole of a cabin. The animals are rarely observed on cloudy days, and they do not come out so early in the morning as

SAY'S SPERMOPHILE

A well-known Ground Squirrel of the Colorado Mountains, that is often a nuisance to settlers and campers

the Chipmunks do, but await the warming rays of the sun.

Merritt Cary states that he observed a female and two young, about a third grown, romping among some loose rocks on the banks of Clear Creek, Colorado. "When the old Squirrel first saw me she ran to the little ones and pushed them back into a hole among the rocks with her fore feet. As soon as she had left them the youngsters came out and began playing again. The mother returned and again pushed them into their safe retreat, appearing much excited at my presence. This was continued for a number of times, until I tired of watching the performance."

EASTERN CHIPMUNK

Tamias striatus (*Linnaeus*)

Description.— The Eastern Chipmunk, while formerly classified in the same genus with its host of relatives living in western North America, is now generally placed in a genus by itself because of the following characters. Its back is not so finely striped as the smaller western Chipmunks, nor does it have as many stripes; its size is noticeably larger and its body heavier. It closely resembles a group of western Ground Squirrels, the Say's Ground Squirrel group, but can be quite easily distinguished from the latter through lack of any chestnut coloring on the head or neck. The Eastern Chipmunk is of small size; head rather rounded; ears short but prominent, clothed with short hairs; body trim but not slender; tail broad and flat, moderately bushy, about half the length of head and body; general coloration rusty brown above, with five black and two light-colored stripes on back, and with deep chestnut on rump; underparts whitish. An animal of rather active habits.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{1-1}{1-1}$; Molars, $\frac{3-3}{3-3}=20$.

Pelage.— Adults: Sexes identical. Rather brighter in summer than in winter. Color above reddish-brown or rusty, with some grayish-brown, shading into tawny-brown on cheeks and sides, and with deep chestnut rufous on flanks and rump; five black stripes on back from shoulders nearly to tail, central one bordered by two brownish stripes, and a stripe of tawny-white on each side separating the two outer black stripes. Underparts whitish; tail above, blackish to brownish, fringed with yellow; below, yellowish-brown bordered with black and fringed with gray. Hair everywhere rather short and moderately soft. Young: Like adults, but colors weaker.

Measurements.— Sexes of equal size. Total length, 9.7 inches; tail vertebrae, 3.7 inches; hind foot, 1.2 inches.

Range.— From northern Illinois, Iowa, northward through Wisconsin, Minnesota and Michigan to about latitude 49°.

Food.— Largely seeds, grains, nuts, acorns but also a certain amount of animal food such as young mice, birds' eggs and insects.

Related Subspecies

Eastern Chipmunk.— *Tamias striatus striatus* (Linnaeus). The typical animal of the above description. Southern New York through Atlantic States to Georgia.

Gray Eastern Chipmunk.— *Tamias striatus griseus* Mearns. Large, black markings pronounced, other colors subdued. Upper Mississippi Valley west of Great Lakes.

Lyster's Eastern Chipmunk.—*Tamias striatus lysteri* (Richardson). Rump and thighs bright yellowish-red. From north latitude 50° in eastern North America, south to northern New York, west to Michigan and Ontario.

Bangs's Eastern Chipmunk.— *Tamias striatus venustus* Bangs. Colors brighter and back stripes shorter. Oklahoma.

The Chipmunk may be popularly described as a small edition of the Tree Squirrel. It has much the same shaped head and body, the same bright eye, and the same perky frisk of the tail. In size, however, it is only about one-third the size of its neighbor of the upper stories. It is only about eight or nine inches long, including the long bushy tail; or only five or six inches for the head and body proper.

Chipmunks have also been called Rock Squirrels because of their fondness for making a home among rocky crevices. Failing this convenient retreat, they inhabit fence corners or decayed tree trunks that can be entered from the ground.

Since they are too small to attract the attention of hunters, they have long since ceased to exhibit any lively fear of man. On the contrary, they become easily tamed and may be attracted by any patient passer-by in a woodland, or seen roaming at large in our parks.

Although the Chipmunk ranges over the greater part of North America, there are great tracts of country where it is absent or nearly so. These are the continuous stretches of gloomy forests. A bright, alert, saucy creature itself,

it is most at home where it may dart into the sunshine at any moment. The rocky, scrubby, dry pastures of New England are ideal for it, especially when scattered clumps of oak, chestnut and beech trees are nearby.

The homes of most burrowing animals are advertised by conspicuous earth mounds at the tops or edges of which the burrows open. The Woodchuck and the Prairie Dog are good examples of this. The Chipmunk, however, is wiser. Not only does it not make such mounds, but it takes pains not to make paths leading to the mouth of its burrow. Probably this is done by approaching the burrow from as many different directions as possible, and by moving in long wavelike leaps. The burrow openings, too, are often placed in inconspicuous spots, such as under the edge of a stone, or under a stump or tree root. Considerable cunning is exercised in the making of the Chipmunk's home. The burrow may be started in an open spot and run in various directions with chambers of different sizes, up to a foot in length, placed here and there. Eventually the tunnel has at least two other entrances besides the original one. This is finally closed up, and only hidden openings are left. Just how the Chipmunk carries the dirt from the tunnels and chambers to some distance away, is a disputed point. Some naturalists believe the large pouches are used only for carrying food. The use for conveying dirt is possible. To carry such a large amount of dirt to considerable distances in the fore-paws would require a long time. The burrows are about two inches in diameter, several yards long, and from a foot or less to three or four feet below the ground surface.

If one can think of a Chipmunk with a bad case of mumps, one would have a good conception of that animal with its cheek pouches filled with food. When full these pockets nearly treble the size of the head. As many as four hickory nuts have been found in them. Like a small boy's pockets these pouches may be filled with all kinds of edibles, especially vegetable matter. Acorns, hickory nuts, beech nuts and all kinds of seeds and grain form a large part of the vegetable menu; while insects in their various stages, bird's eggs and young, and other freshly killed animals of many kinds find a place in its dietary at times.

August, September and October are the harvest months for Chipmunks. Then they are very busy gathering seeds and nuts and storing

Photograph by G. W. Stark

EASTERN CHIPMUNK

A bright-eyed, alert little rodent that has been called the fairy of the mammal world

them in underground granaries connected with their burrows. Over half a bushel of such food has been taken from a single chamber, and it is a common thing to find several quarts in one place. Sometimes a few nuts are deposited by digging a slight distance below the ground surface in the same way that Gray Squirrels store

Photograph by J. M. Johnson

EASTERN CHIPMUNK

Caught sunning himself on a stone wall

food. These, however, seem to be only temporary deposits which are soon eaten or taken to the main granary. No food of an easily perishable character, like grasshoppers, is stored.

There is considerable difference of opinion in regard to the use of this reserve food. Is it eaten during the long winter months underground, or does the Chipmunk sleep then and use the supply in the early spring when other food is scarce? Unlike many other hibernating animals, the Chipmunk is not particularly fat on retiring to its burrow. It is probable that it eats some of its stores at that time in order to get into good condition for its long sleep, leaving the bulk of it for its spring breakfast. The period of hibernation varies with the latitude. In New York it is from about October first to April first, the length of time depending upon the severity of the season.

The final awakening comes with a rush. When the Chipmunk emerges from its burrow there is no sign of long sleep. Then is the time for love making and for mating. It is probable that Chipmunks pair at least for one season. The four or five blind, naked young are born about a month after the mating of the parents, and may be seen in the upper world in late May or in June according to the latitude. There is some evidence that two litters may be produced in a season.

In addition to its other accomplishments the Chipmunk sings. Those of a given locality will gather and sing their chirping notes for many minutes together, sometimes loud and cheery, sometimes soft and in a conversational tone. From this "chip, chip, chip!" has come the name. With its airy grace, its quick alert movements, its shiny eyes, its bright coloring and its happy notes, the Chipmunk is the veritable fairy of the mammal world.

Like most rodents the Chipmunk's enemies are many. All the larger birds of prey find it a choice morsel. Carnivorous mammals get it whenever they can. Badgers will even dig out burrows to get it. The deadliest enemy of them all, however, is the Weasel. Wherever the Chipmunk can go the Weasel can follow, and the only chance of escape left to the pursued animal is to plug up its burrow with dirt.

We should miss the Chipmunk sadly were it exterminated, yet it is necessary to keep the numbers within moderate limits, because of the many young birds which would become its prey, if it were not kept in check. While it does not climb to any extent, it does scent out low-built nests. The damage done to grain in most parts of the country is slight, and is more than repaid by the pleasure of its cheery company.

J. M. Johnson.

SAY'S CHIPMUNK

Eutamias quadrivittatus (*Say*)

Other Name.— Busy Chipmunk.

General Description.— Say's Chipmunk may be selected as representative of the whole genus *Eutamias*, a very large group ranging in general over almost all of North America. The latest authoritative list records no less than 47 species and subspecies of this small mammal known north of the Rio Grande. Roughly speaking they are all very much alike, most of them having the upper parts striped with the same pattern, namely 5 dark and 4 lighter, dorsal, longitudinal stripes. However, owing to the great variety of habitats in which Chipmunks live, the greatest diversity is found in coloration and to a certain extent in size. This group is a very plastic one, that is, its members reflect readily the environmental influences about them, and thus in desert species we find very pale coloration as the result of excessive sunlight, while in regions of heavy rainfall dark, rich-colored forms occur. As might be expected, certain changes of habit are also correlated with changes in environment, although the economic niche fitted by this animal is much the same wherever it is found. Say's Chipmunk is small and slender, being only about half the bulk of the Eastern Chipmunk. Head moderately rounded; ears somewhat narrow, erect and well clothed with short hair; body slender and trim; tail about as long as head and body, and moderately bushy and flat; legs short. Color above, a series of dark and light stripes; hair of moderate length and soft. Very active and excitable in manner.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3} = 22$.

Pelage.— Adults: Sexes identical. *Summer* pelage. Above, grayish grizzled chestnut or rufous with conspicuous longitudinal striping as follows: a median black stripe extending from between ears nearly to base of tail; on either side of median stripe, a lighter stripe of nearly same tone as color of sides, or more often, grayish-white; then a black stripe, edged with rufous and ending about an inch behind ear; finally an almost clear white stripe; behind ears a small patch of whitish-gray; grayish-white stripes above and below eyes; dark facial stripes; top of head gray; under surface of body white, the hairs blackish at base; tail above, mixed black and rufous; below, rufous, black bordered. *Winter*. The whole general tone of the upper parts grayer, with dorsal stripes less black and more rufous, and light stripes grayer; sides and flanks duller; under surface of tail more chestnut. Young: Striped like adults but coloration weaker.

Measurements.— Total length, 8.5 inches to 9.5 inches; tail vertebrae, 3.7 inches; hind foot, 1.3 inches.

Range.— Southern Colorado northward through Wyoming, in forested regions and brushy places.

Food.— Seeds of various kinds, acorns, some insects and birds' eggs.

Related Species

Say's Chipmunk, or Colorado Chipmunk.— *Eutamias quadrivittatus quadrivittatus* (Say). Typical animal of the above description. Colorado and Wyoming.

Yellow-bellied Chipmunk.—*Eutamias quadrivittatus luteiventris* (Allen). Colors bright; body beneath buffy. Rocky Mountains in Montana northward into British Columbia.

Northern Chipmunk.—*Eutamias quadrivittatus borealis* (Allen). Smaller than Colorado Chipmunk; pale yellowish-gray above. Northern North America, Hudson Bay to eastern base of Rocky Mountains south to Montana.

Least Chipmunk.— *Eutamias minimus minimus* (Bachman). Smallest of the Chipmunks, length 8 inches. Colors very pale. A desert form. Bad Lands and plains of Dakota, Montana and Wyoming.

Oregon Chipmunk.— *Eutamias amoenus amoenus* (Allen). Smaller in size than Colorado Chipmunk, colors paler. Fort Klamath, Oregon to northern California and western Nevada.

Utah Chipmunk.— *Eutamias dorsalis utahensis* Merriam. Single dorsal stripe alone conspicuous; coloration rusty brown. Northern Utah to New Mexico.

Townsend's Chipmunk.—*Eutamias townsendii townsendii* (Bachman). Largest of the Chipmunks; coloration very dark; above ferruginous rufous; tail about three-quarters length of head and body. Coast region of Oregon, Washington and British Columbia.

Merriam's Chipmunk.— *Eutamias merriami merriami* (Allen). Size large; colors pale; stripes not strikingly contrasted. California.

Hopi Chipmunk.— *Eutamias hopiensis* Merriam. Medium size; general appearance bright chestnut or rufous. Northern Arizona, southern Utah and southwestern Colorado.

Long-eared Chipmunk.— *Eutamias quadrimaculatus* (Gray). Size large; facial stripes very distinct; ears large; coloration grayish. California.

Busy is just the word to characterize this little Chipmunk. From morning until night he is on the move in whole or in part. Now he is dashing from his burrow to disappear in a rock pile, only to bob his head out a moment later. Now he skips quickly to a bush of bright red berries, and branch after branch shakes as he goes from one to another gathering his breakfast. Some he takes to a nearby boulder, sits up and proceeeds to eat, holding and turning the berries in his hand-like fore-paws much as a person would do. So he goes all day long.

The Chipmunk's tail seems to have some hidden connection with his vocal cords. Up goes his

tail, out comes a whistling bark, down jerks his tail, out comes another bark. He never whistles or barks without a jerk of the tail. It seems to be a trigger to set off his emotions.

The "Say" Chipmunk is one of several species found throughout the West, and often varies externally only slightly in color. An expert naturalist can hardly determine the members of the different races in the field where the ranges of two or more overlap. The main characteristics of this form, therefore, will be those of all. Food, of course, will vary somewhat with the locality. That of the desert will be somewhat different from that of the mountains. The Western form of Chipmunk is even less a creature of the woods than its Eastern relative. It is seldom found in trees, while the Eastern cousin has been seen running up small trees after food. The open country is more suited to its taste, with trees and berry bushes scattered about, and plenty of rock-strewn, sunny spaces between. In these spaces it finds holes among the rocks for its home, or it may make a burrow.

Acorns, seeds of pine and of spruce trees and various other seeds furnish its principal food. It is likely however, that it will eat insects and young birds when the occasion offers.

In autumn it lays up a generous supply of food, and when the weather begins to get cold the Western Chipmunk, like its Eastern cousin, takes to winter quarters, curls up and sleeps. In parts of Colorado it seems to break its slumber occasionally, as it has been seen every month during mild winters.

Four to six young appear in spring or early summer according to the altitude. Where camps are established, mills built or a new section of country is irrigated, the Chipmunks are sure to swarm to get the extra food afforded by the refuse thrown out, or by the extra grain raised. In Yellowstone National Park a closely related species is very abundant at the camping places established at intervals along the roads. The at-

Photograph by J. M. Johnson

SAY'S CHIPMUNK

Busy is just the word to characterize this little fellow. From morning to night he is on the move

traction is the waste grain and the camp refuse. In such places they become very tame, even to the point of eating out of a person's hand.

Like most Chipmunks the Say is out in greatest abundance during the early morning hours or late in the afternoon, and may be seen frisking about the rocks and stumps of trees, on the sides of canyons, or along fences, or busily feeding in the thickets of wild cherry and June berry so abundant in the canyon bottoms. It is usually shy, and when surprised hastily takes refuge among the rocks, uttering high-pitched chippering notes. The ordinary note, however, is a soft "chuck, chuck," usually uttered when the animal is at a distance from the observer and either sitting on the summit of a large rock far up the canyon side or on a tree stump in the silence of the yellow pine forest.

The *Hopi Chipmunk* gets its name from the Hopi Indians near whose reservations it is found. It is at home in the cedar and pinyon pine regions of parts of Arizona, Utah and Colorado. It is darker than the Least Chipmunk, but lighter than the forms living in the forested plateaus and mountains. Its general habits are similar to others.

In size and general appearance the Hopi Chipmunk resembles Say's, but its movements are more deliberate and its colors much brighter and richer. The long tail is carried more nearly horizontally, even when the animal is running. This striking habit, together with the graceful downward curve of the tail near the tip, serves to distinguish it, even at a distance. The Hopi Chipmunks appear equally at home among the hot rocks in the precipitous canyons, and in the dense juniper and pinyon growth which clothes the bordering mesas. They feed extensively upon juniper berries.

The *Least Chipmunk* is another of the several species and subspecies which make the region west of the Mississippi River their home. The greater diversity of the climate and country results in a greater variation in animal forms inhabiting it. One species will live in the very lofty mountains, another in the sagebrush desert, and the third in the prairie regions. This Chipmunk has the same general appearance as the other Western Chipmunks, but is much lighter in ground color, as might be expected from the fact that it lives in the sagebrush deserts of parts

Photograph by J. H. Field

BANGS'S CHIPMUNK

A middle-western member of the Eastern Chipmunk group

Photograph by the U. S. Biological Survey

YELLOW-BELLIED CHIPMUNK

of Montana, Wyoming, Colorado and Utah. It is interesting as being the smallest of all the Chipmunks. Ordinarily it is shy, but it soon becomes tame about camps if not molested.

Townsend's Chipmunk is a large dark form found in the coast regions of British Columbia, Washington, Oregon and California. The light and dark stripes are not nearly so pronounced as in the Say Chipmunk, or the other closely allied forms. This is the largest of all the Chipmunks.

EASTERN WOODCHUCK

Marmota monax (*Linnaeus*)

Other Names.— Eastern Marmot; Groundhog.

General Description.— A large, heavy-bodied, short-tailed terrestrial Squirrel. Nose blunt; head rounded; ears low and rounded; body robust and generally fat; tail short, less than half the length of head and body, moderately bushy; legs short; hair everywhere rather long and coarse; front feet with four well-developed toes and a rudimentary thumb; hind feet with five toes; general color grizzly-brown. Hibernates in winter.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3}=22$.

Pelage.— Adults: Sexes identical, no marked seasonal variation. General color grizzly brown, the hairs on the back with gray tips and blackish at base; belly and underparts brownish-chestnut; nose and chin gray; cheeks and throat yellowish-white; feet black or dark brown; tail dark brown with gray tips to many of the hairs. Variations on this typical coloration are not infrequent, some individuals being much darker. Young: Pale brownish.

Measurements.— Total length, 22 to 25 inches; tail vertebrae, 5 to 6 inches; hind foot, 3.4 to 3.7 inches. Weight about 8 pounds.

Range.— From New York to Georgia, west to the Dakotas and south to Virginia, Kentucky and Tennessee.

Food.— Green vegetation, roots and grain.

Remarks.— Woodchucks are closely related to the Prairie Dogs and Ground Squirrels, or Spermophiles, but may be easily distinguished from any of these by their large size, as they are without question the largest squirrel-like mammal of North America. Ranging over a great part of our continent north of 35° latitude to the Arctic circle, the Woodchuck has become well differentiated into several distinct types, and in addition, local variations of these types have been described, making in all thirteen species and subspecies.

Related Species

Eastern Marmot.— *Marmota monax monax* (*Linnaeus*). The typical animal as described above.

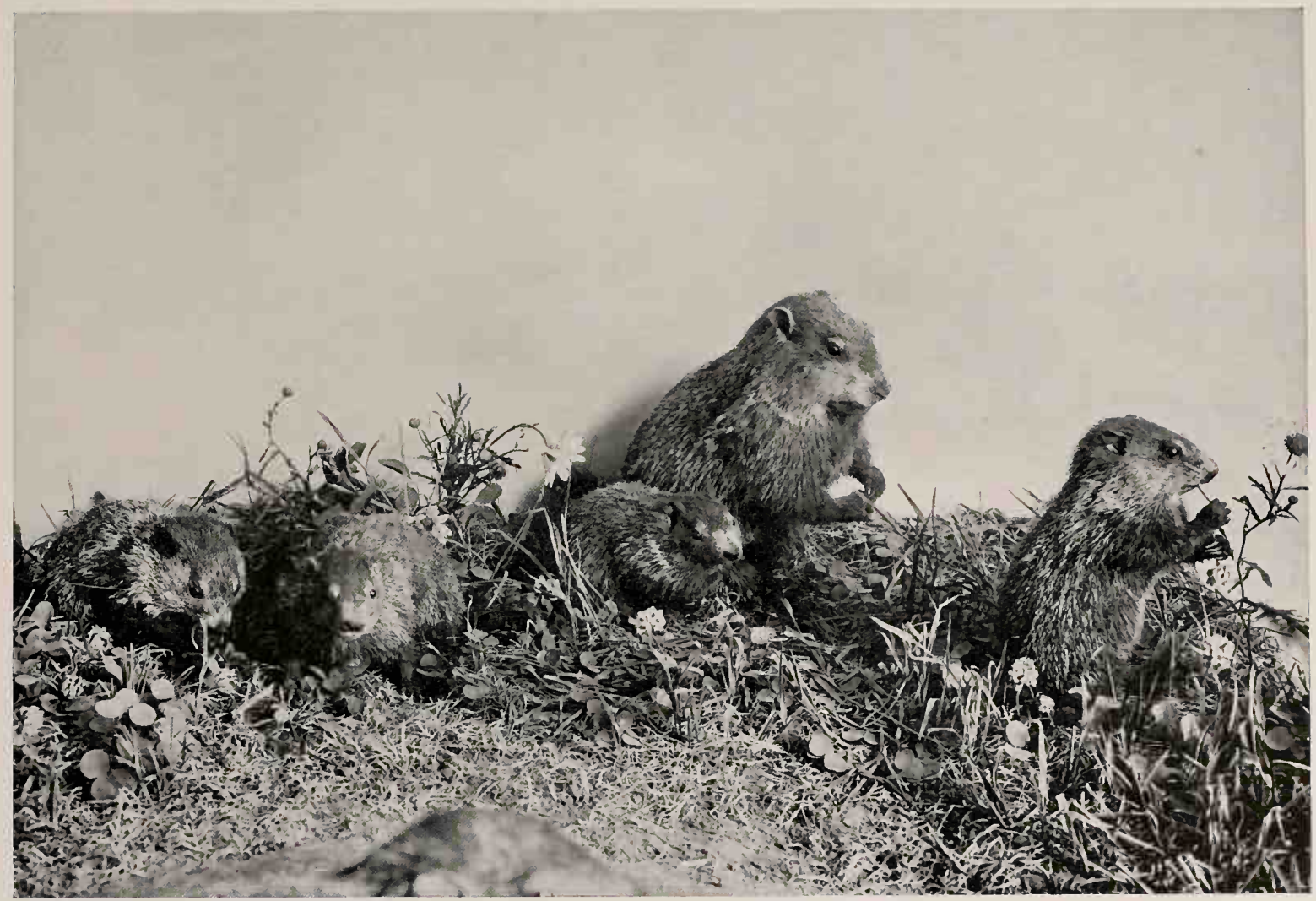
See also Hoary Marmot, and other western forms.

Every farm boy and girl knows the Woodchuck, for he is as much a part of the farm as the brook or the sugar-bush. In a tramp through the fields almost any time during the spring or summer, one is likely to catch a glimpse of him as he waddles away to his burrow, or possibly to his den in the wall or stone-heap, which he sometimes prefers for a summer home. Those who know him well can easily distinguish his home by the peculiar odor which is always present.

When our grandfathers were boys the Woodchuck usually had his home in the woods, where he fed on the tender bark and roots of various kinds, but today we find him more inclined to the fields, near the farmer's clover-patch. There is a touch of laziness in his disposition and probably he finds the clover-patch an easier place to get his living. Then, too, it is nearer the garden where he can occasionally taste the juicy peas, beans, and lettuce, of which he is very fond. But he has greatly added to his danger by this change, for here the farmer continually wages warfare against him from early spring until fall. Many are trapped, some are shot, and others are killed by farm dogs.

Trapping is easier in May or June than later in the summer when experience has made them wise and timid. Sometimes, leading from the burrow is a well-defined path through the grass, and in this the trap is set, but usually it is placed at the entrance of the burrow and made fast to a stake which is driven into the ground. Old Woodchucks at last become very shy and develop great skill in detecting and avoiding the dangers of the traps. Sometimes one of them will spring a trap day after day without being caught, or even dig around the trap.

After the grass has been mowed in the meadows and he can no longer hide himself, the Woodchuck becomes still more shy, for he must now look out for the farmer and also the village sportsmen, who often betake themselves to the



Photograph from the American Museum of Natural History

A FAMILY OF EASTERN WOODCHUCKS

This is a still-life group which shows both old and young animals in characteristic attitudes

country on leisure afternoons, to indulge in Woodchuck hunting.

Then, too, he must reckon with the farm dog, which frequently develops great ability in nosing him out. A certain dog by the name of Shep, well known to the writer, was a famous Woodchuck hunter. Shep would locate a Woodchuck, and then, while it was feeding, would move quietly toward it, always keeping her body close

Photograph by F. N. Whitman

"TAKING A GOOD LOOK"

Characteristic pose of a fat, lazy Woodchuck who unwittingly sat for his portrait

to the ground, but stopping instantly and lying still whenever the Woodchuck raised himself upon his haunches to look about and listen for danger. This performance was repeated by Shep until she believed that she was near enough to the burrow to prevent the Woodchuck from reaching the entrance first. Finally she would make a dash for it, and usually there was one less Woodchuck.

The real home of the Woodchuck is the tunnel or burrow in the ground, which varies in length from ten to twenty-five feet, and is two or three feet below the surface. The entrance to the burrow slants sharply down and then up to the general level, which secures better drainage. The Woodchuck is somewhat of an engineer, though not so good as the Beaver, and realizing the importance of drainage, most frequently chooses the hill-slope site. The main burrow ends in a chamber of sufficient size for the occupants to turn around comfortably. There may be one or more side tunnels, varying in length from three to five feet. Frequently at the end of one of these is an observation outlet, which also may be used in times of invasion by other animals, such as the Fox, Mink, or Skunk.

The home life of the Woodchuck, as well as that of other animals, is most interesting. The writer was fortunate enough to know quite well one Woodchuck family. They lived by the old rail fence, just back of the orchard on a sunny slope, the mother and five little ones. The cubs were born about the first of May in a snug little chamber, at the end of the main burrow, containing a small bed of dry grass and leaves gathered the fall before by the mother. The mother made herself known by a shrill whistle of alarm at Rover and his boy master as they were on their way to the trout stream one rainy morning in early June. The dog ran quickly in the direction of the sound and was soon at the entrance of the burrow, thrusting in his head, wagging his tail, and uttering the short, quick yelps so characteristic of the shepherd dog.

The mother was too thoroughly frightened to venture out again, probably for an hour or more, but one day a little later she appeared at the door of the earth-castle, and the five cubs came tumbling along the narrow passage after her. It was evidently the first time they had opened their great wondering brown eyes on the outside world. The sweet odors from the meadows whispered to their awakening instincts of the clover and grasses they would soon be hunting for themselves. The song of the wren from the old orchard, the merry tune of the bobolinks, the whistle of the meadow lark, and the buzz of insects told them of other dwellers in their new world.

The mother was more alert than usual for all sounds which threatened danger to her family, and did not venture from the entrance until a thorough survey of the surroundings had been made. When satisfied that danger was not lurking in the immediate vicinity, she led the way into the grass and began nibbling the clover leaves. Instinctively imitating her, the cubs followed close after their mother and also began nibbling the juicy leaves with their sharp little teeth. They were learning their first lesson in the meadow — how to eat.

The real object of their outing was accomplished when they had filled their stomachs, and then they began playing about in the grass very

much like puppies or young foxes, but the mother was careful meanwhile to keep them close to the entrance of the burrow. Suddenly the trained ear caught an unwelcome sound and she hustled the little ones into the burrow and quickly followed. They were scarcely safe when a dog appeared over the knoll, running straight for them. The cubs could have traversed but a part of the tunnel before they heard the deep breathing of the dog at the entrance of the burrow. Their hearts must have beat fast from the excitement and unusual exertion, but the threatened danger from others that meant no harm. One of the most important lessons was on the nature of their natural foes.

In early fall the young Woodchucks were nearly full grown. Their education was complete, and the time drew near when they must find homes for themselves, either taking a deserted burrow, or digging a new one, and settle down to the serious business of life.

Usually each young Woodchuck has a burrow by itself, but sometimes a pair will live together during the winter. From October to March, in

Photograph by S. A. Lottridge

WOODCHUCKS HIBERNATING

A remarkable life photograph, in that it not only shows the actual animals asleep, but also that they may hibernate in pairs, for warmth, instead of singly, as is generally supposed

experience had added one more fact to their first day's lesson, and they understood that there were animals to be avoided in the strange outer world they had just discovered.

Their education progressed rapidly from day to day. A part of it came through imitation of their wonderful mother, but by far the greater part came through instinct and experiences of their own. They learned to tell the clover from the plantain, and to know the grasses that were good for food and medicine, from those that must be let alone. They could distinguish among the sounds that came to their ears, those that

general, the Woodchuck is said to "hole up" or "den." This means passing the dreary winter months of sleet and snow in the deep sleep called hibernation.

The Woodchuck is the only animal that has been honored by a special day on our calendar. "Ground Hog Day" (February 2) is so called because of the popular belief that, on this day, the animal takes its first weather observation after its long winter sleep. If it sees its shadow (that is, if the sun is shining) back it pops into its hole, and we are in for six weeks more of winter.

S. A. LOTTRIDGE.

By permission of the New York Zoological Society

EASTERN WOODCHUCK

This was one day when the Groundhog, as he is familiarly called, could see his shadow. Photograph one-fifth life-size

HOARY MARMOT

Marmota caligata (*Eschscholtz*)

Other Names.— Gray Marmot, Whistling Marmot.

General Description.— Much larger than the Eastern Marmot, or Woodchuck, but with the same general build and habits.

Dental Formula.— Same as foregoing.

Pelage.— ADULTS: Sexes identical, no marked seasonal variation. General color much lighter than Eastern type. Above, grayish-white, the tips of hairs having pronounced grizzled-whitish tinge. Sides and underparts shading from grayish-fulvous to black. YOUNG: paler.

Measurements.— Total length, 29 inches; tail vertebrae, 7 inches. Weight, 10 pounds.

Range.— Columbia River northward to the Barren Grounds, east to Hudson Bay.

Food.— Roots, small plants, seeds, and grain.

RELATED SPECIES

Hoary Marmot.— *Marmota caligata* (Eschscholtz). Typical animal of above description.

Eastern Marmot.— *Marmota monax monax* (Linnaeus). See preceding article.

Yellow-bellied Marmot.— *Marmota flaviventer flaviventer* (Audubon and Bachman). Size large, coloration much as in Eastern Marmot, underparts golden, tail rusty yellowish. Western Texas, New Mexico and Arizona north to 49°.

Dakota Marmot.—*Marmota dacota* (Merriam). Size large; hairs on shoulders elongated to form a mantle, yellowish-brown mixed with black above; head black. South Dakota.

Olympic Marmot.— *Marmota olympus* (Merriam). Size equal to Hoary Marmot; yellow ochraceous above; dark bar across face. Olympic Mountains, Washington.

Photograph by U. S. Biological Survey

YELLOW-BELLIED MARMOT

A large western type which can be readily distinguished by the beautiful golden tint on its underfur

The Hoary Marmot and its western cousins are in general considerably larger than the Eastern Woodchuck, but can be readily recognized even by the casual passerby as near relatives of that familiar animal. In colors the western members range from the grizzled gray of the Hoary Marmot, which ranges the Canadian Barren Grounds, to the Yellow-bellied Marmot of the Southwest, a beautifully marked animal that can be readily distinguished by the golden hue of its underfur. Here once again we see the protective coloring afforded by nature. In the northern wastes the animal is given the indiscriminate gray which blends so perfectly with the landscape; while in the southern deserts it reflects the hues of sand and rocks.

The general habits resemble those of the Eastern type, with such changes as may be made necessary by locality. For example, in the far North the period of hibernation is very long, because of the length of the winter; while in the southern deserts it is doubtful if the Marmot hibernates at all. A noteworthy feature about the whole tribe is their ready adaptability to almost every climate. They seem to thrive almost equally well in southern climes and in frozen wastes as high as latitude 63°. They are found on the deserts and also on the very tops of mountain peaks. Says Merritt Cary: "The Marmot is one of the most characteristic mammals of the mountains, and occurs from 6000 feet in the foothills to the rocky summits of the highest peaks, at over 14,000 feet. It has, therefore a vertical range of about 8000 feet. Marmots are much more abundant above than below 8000 feet, and are especially numerous in the slide rock near timberline. They are reported present on the summit of Gray's Peak, at an elevation of 14,341 feet, and have been observed also on the summit of Long's Peak 100 feet lower. The clear, shrill whistle of the Marmot is one of the few sounds that break the silence of the high altitudes, and the large reddish-brown animals may often be seen sunning themselves on the warm, flat surface of rocks during the middle of the day. In the Hahn's Peak region Marmots are abundant, and are usually seen around abandoned prospect holes and mining shafts."

The Hoary Marmot is also called the Whistler, from its call — a shrill whistle used not only as a danger signal but as a means of communication at all times. It seems, in fact, quite proud of its vocal efforts, which are often practiced continuously, and its pleasant call has cheered many a lonely traveler.

PRAIRIE DOG

Cynomys ludovicianus (*Ord*)

General Description.— A stout-bodied, terrestrial Squirrel of the Plains regions. Head blunt, rounded; ears low and broad; body thick set; tail very short, about one-third length of head and body, slightly bushy; legs short; claws long; general color, reddish-brown grizzled with grayish above; beneath, yellowish-white; hairs fairly long and coarse. Lives in colonies.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3}$=22.

Pelage.— Adults: Sexes identical. *Summer.* Above, reddish-brown, brightest and clearest on shoulders and top of head, on back and rump, grizzled with black and white; flanks paler; sides of head and body and upper surfaces of feet, yellowish; underparts yellowish-white; tail above and below like shoulders, with apical third black. *Winter.* Above, pale vinaceous buff, grizzled and mixed with black; below pale buff. Young: A paler brown.

Measurements.— Total length, 14 inches; tail vertebrae, 3 inches; hind foot, 2.3 inches.

Range.— Western Texas to 49th parallel, and western Kansas as far east as the eastern base of Rocky Mountains.

Food.— Largely grass, roots and blades, and other vegetation.

Related Species

Common Prairie Dog.— *Cynomys ludovicianus* (Ord). Typical animal as described above. Western Texas to 49° north latitude, and from western Kansas to eastern base of Rocky Mountains.

Gunnison Prairie Dog.— *Cynomys gunnisoni* (Baird). Darker in color; tail tipped with white. New Mexico and Colorado to Arizona.

Arizona Prairie Dog.— *Cynomys arizonensis* Mearns. Largest of the Prairie Dogs; pale sandy buff above; tail with narrow sub-terminal bar of black. Texas and Arizona.

White-tailed Prairie Dog.— *Cynomys leucurus* Merriam. Size large, tail like back at base, but outer two-thirds white with a few black hairs. Wyoming and Colorado.

The Prairie Dog lives upon and just under the surface of the ground. It is not a climbing animal, but devotes its surplus energies to burrowing. It is of social disposition and is always to be found in colonies often of large size. It is related, on the one hand, to the Spermophile, and, on the other, to the Marmot, but may be easily distinguished from either of these by the markings outlined above. The name "Dog" as applied to this animal is, of course, inaccurate, as it is a true rodent.

Ever since the first explorers penetrated the Western plains, these sociable little beasts have been known and liked, despite their propensity for mischief. Today as one looks out of the car-window, he will be rewarded by seeing a little inquisitive head pop out of a hole, or a sentinel-like animal sitting gravely at his threshold as though monarch of all he surveyed. In commenting upon this trait, an early explorer says: "This interesting little animal never fails to attract the attention of every traveller on the Western plains; and an approach to one of their settlements, after long and dreary marches, is always hailed with delight as a pleasant change from the monotony of lifeless scenes to one of cheerful activity and motion. Such occasions excite a certain degree of pleasure in every one as he watches the motions of these curious creatures as they at first assemble in numbers, as if in grave consultation in regard to the intrusion of strangers upon their quiet domain. Upon the too near approach of apparent danger, suddenly the assembly is dispersed, each one retires to his respective home and standing upon the edge of his den, utters his peculiar bark as if in defiance; and then every one disappears suddenly and every voice is hushed when a single gun is discharged."

By permission of the New York Zoological Society

PRAIRIE DOG COLONY

A characteristic picture of Prairie Dogs showing how they cut and hold their food

Prairie Dogs are easily introduced into almost any open country where the ground is dry, but they are very difficult to exterminate. They breed readily in captivity, and usually produce four young at a birth. In 1899, says Dr. Hornaday, a free colony was established in the New York Zoological Park in the Antelope Range, where it existed for two years, and its saucy members attracted far more attention than those confined in the fenced village. Knowing that guns and dogs were not allowed in the Park, they often permitted visitors to pass within six feet of them. But it proved impossible to keep

those industrious diggers from spreading far beyond the limits fixed for them, and seriously damaging walks and lawns, so they were finally caught by placing sand in boxes over their burrows, and transferred to the village whose walls of solid masonry go down to bed rock.

Photograph by P. C. Kangieser

PRAIRIE DOG

These rodents are among the most familiar animals of the Western plains. This photograph was taken in Kansas

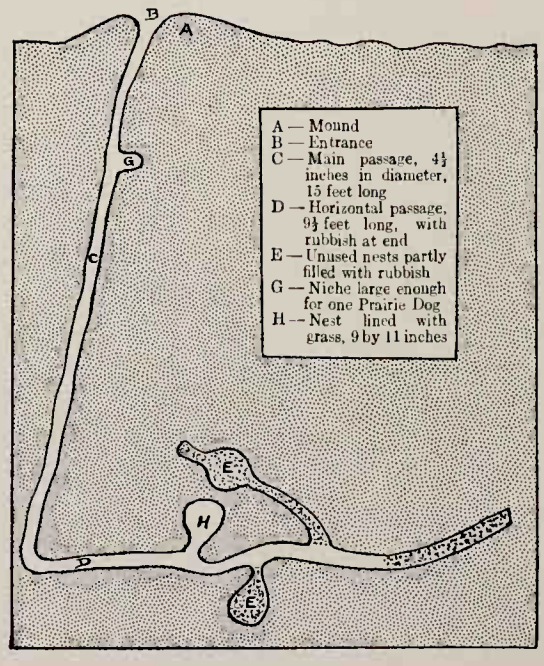
It has been asserted that these interesting little fellows are able to locate their towns away from streams because they burrow down until they strike water, but Dr. Merriam points out the fact that in some regions they live where the nearest veins of artesian-well water are 1000 feet below the surface. As a matter of fact they can live without drinking.

The Prairie Dog flourishes over a wide extent of western country, from Texas, New Mexico and Arizona northward to the Canadian boundary. It is also at home on the western slope of the Rocky Mountains in Utah and Colorado and is most abundant in Montana, Wyoming and western Kansas. One of the largest Prairie Dog towns yet reported begins in Trego County, Kansas, and extends along the divide north of the Smoky Hill River, practically without a break, to Colorado, a total distance of about 100 miles. This town varies in width from half a mile to five miles, and on the top of the divide the nearest water is believed to be 350 feet below the surface.

It is not true, says Dr. Hornaday, that the Prairie Dog lives in peace and harmony in the same burrow with the rattlesnake and burrowing owl. The snakes would make short work of the young Dogs, and the latter would quickly kill the owl! When a quarrelsome rattler invades the home, the Prairie Dog speedily seeks quarters elsewhere. The burrowing owl is in the habit of taking refuge in abandoned burrows, and nesting in them, to save the labor of digging a burrow for itself. In the Philadelphia Zoological Garden Mr. A. E. Brown once tried the experiment of associating burrowing owls and Prairie Dogs. The owls were immediately killed and torn to pieces.

In the "Yearbook of the Department of Agriculture" for 1901, Dr. C. Hart Merriam publishes a valuable paper on "The Prairie Dog of the Great Plains," which contains the following illustrated description:

"The holes go down for some distance at a very steep angle and then turn at nearly a



PRAIRIE DOG BURROW

This diagram made from actual measurements of an excavated burrow, by Dr. C. Hart Merriam, and published in the Yearbook of the U. S. Department of Agriculture, for 1901, is an excellent "ground plan" of this sociable rodent's home. It is remarkable for the great depth and length of the tunnels

right angle and continue horizontally, rising somewhat toward the end. The nests are inside the chambers connecting with the horizontal part of the burrow, and usually, if not always, at a somewhat higher level. Recently, at Alma,

Nebraska, W. H. Osgood dug out a burrow, of which he made a careful diagram, accompanied by measurements.

"In this case the burrow went down nearly vertically to a depth of fourteen and one-half feet below the surface when it turned abruptly and became horizontal. The horizontal part was thirteen and one-half feet in length. One-third of the horizontal part and two old nests and passage ways were plugged with black earth brought in from the surface layer, which was very different from the light-colored clayey earth in which the greater part of the burrow lay.

"Four or five feet below the entrance was a short side passage probably used as a place in which to turn around when the animals come back to take a look at the intruder before finally disappearing in the bottom of their burrows. It was also used, apparently, as a resting-place where they bark and scold after retreating from the mouths of the burrows. As elsewhere noted, they are often heard barking after they have gone in.

"The burrow was opened the day after bisulphide of carbon had been used for destroying the animals, and the material carrying the bisulphide was found at the bottom of the vertical part, just where the horizontal part turns off.

"The Prairie Dog has several natural enemies which, when not interfered with by man, usually serve to hold its members in check. The most inveterate of these appear to be the coyote, badger, ferret and rattlesnake."

The *White-tailed* is not unlike the *Gunnison* Prairie Dog in size and general coloration, but may be readily distinguished from the latter by its white tail and by the broad dusky patch which covers the eye and extends down over the cheek. Merritt Cary says of this species: "It is not extensively colonial, the burrows being scattered here and there over the sage plains. The burrows are apparently occupied for many years, and the ejected earth accumulates into very large mounds, often as much as three feet in height and eight or ten feet in diameter. These Prairie Dogs are not very shy and often sit at the mouth of the burrow until approached within a rod. The usual note is a peculiar querulous cry, very unlike the short sharp bark of the common type. Chattering alarm notes also are occasionally heard as one walks through a colony.

"Wherever White-tailed Prairie Dogs live in the neighborhood of cultivated ground they are very injurious to green crops. Loring states that in the vicinity of Grand Junction, Colorado, the burrows are usually in the dry banks of irrigating ditches, and the Prairie Dogs inflict considerable damage on the adjacent truck farms by eating cabbages, cantaloupes, and other crops. While eating, they sit erect on their hind legs, but if disturbed run to the burrows, carrying the food in their mouths. They destroy considerable areas of range grasses and feed extensively in alfalfa fields and hay meadows in the river valleys throughout their range."

Photograph from U. S. Biological Survey

PRAIRIE DOG AT HOME

Showing the characteristic mound around the entrance to its burrow

THE SEWELLEL FAMILY

(*Aplodontiidæ*)

ON account of certain well-defined peculiarities, the Sewellel, or Showt'l has been placed in a family by itself. It has no close relations in America, but seems to be the sole survivor of an earlier type of rodent. Naturalists now place it between the Porcupines and the Marmots, but it bears quite as many points of difference as of resemblance to either of these families. The Sewellel is a rodent about the size and general build of a Prairie Dog. Its body is short and stout, its limbs are short, its head is broad and triangular. The eyes are small and bright. It is ostensibly a tailless animal, there being only a rudimentary stump. Its claws are long and thumbs short. The skull is massive and broad, and there are no post-orbital processes. The mandible is strong and heavy.

SEWELLEL

Aplodontia rufa (*Rafinesque*)

Other Names.— Showt'l; Mountain Beaver.

General Description.— A stout-bodied, tailless, burrowing rodent, squirrel-like in appearance and about the size of a Prairie Dog. Head very broad and blunt; neck short and thick; ears inconspicuous and nearly hidden in the hair of the head; body stout, thickset, muscular; tail rudimentary, appearing externally only as an elongated tuft of hair; legs short, claws long, fossorial; hair everywhere of moderate length, rather coarse; a shorter underfur present; general color rich brownish or chestnut; lighter below. A little-known animal keeping so closely in its burrow as to be but rarely seen.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3}=22$.

Pelage.— ADULTS: Sexes identical. Seasonal variation not noticeably conspicuous. Above, chestnut to reddish-brown, some of the hairs black; beneath, plumbeous, a short underfur showing through the longer hairs; face and ears lighter; hairs of tail like back. YOUNG: Not noticeably different from adults.

Measurements.— Total length, 12 inches; tail vertebrae, 1 inch; hind foot, 2 inches.

Range.— Northwestern Oregon and southern Washington.

Food.— Leaves, ferns and other vegetation.

Remarks.— This little-known animal has no very immediate relationships, being rather a survivor of a primitive type now found only in a very restricted region. It is placed in classification between the Porcupines and the Marmots, but is enough unlike either to warrant being placed in a distinct family. Six species of this queer animal are described, the general variation being in color correlated with a variation in size. In general appearance, however, these different varieties closely resemble one another.

RELATED SPECIES

Rafinesque's Showt'l.— *Aplodontia rufa* (Rafinesque). Typical animal as described above. Northwestern Oregon and southwestern Washington.

Pacific Showt'l.—*Aplodontia pacifica* Merriam. Size small, ear longer; colors dark. Coastal region of Oregon about Yaquina Bay.

California Showt'l.—*Aplodontia major major* Merriam. Larger, total length 14 inches; general color grayish sepia brown grizzled with black. Northern California.

Olympic Showt'l.—*Aplodontia olympica* Merriam. Larger and darker than Rafinesque Showt'l. Olympic mountains, Washington.

Among the many new and, to them, strange and interesting animals, discovered by Lewis and Clark in their famous expedition of 1804–5 was a queer-looking tailless animal called by the Indians of the Columbia river, the region where it was first seen, the "Sewellel" or "Showt'l." The white men had seen nothing like it before, and no doubt they may have wondered a bit as to just what kind of an animal it was, although it was set down in literature of that time as a kind of Squirrel. The Indians brought robes made from a number of skins sewed together

and the explorers noticed that every skin they saw lacked a tail. Eventually they learned that the animal is tailless. Even today it is a strange mammal to most readers for it is to be found only in a narrow belt along the coast of Northern California, Oregon and Washington and not east of the Cascade Sierra Nevada series of mountains; while in addition it is an animal of retiring habits and apt to escape the notice even of the people about it. Much has yet to be learned of the more intimate details concerning this little beast, which in structure is one of the most primitive types of living mammals. The writer's personal observations appeared recently in a Bulletin of the American Museum, some paragraphs of which are repeated.

The Showt'l in some of its habits and in appearance greatly resembles certain large Pocket Gophers.

If not strictly nocturnal it is at least so much so that the animal can rarely be seen during the day. Although a number of runways were visited and I was daily in places where there were evidences of activity, I saw none of the animals themselves. Those caught in traps were frequently alive when the rounds were made in the morning, and one such individual furnished me most of my points on behavior.

The "colonies" of this animal were found most frequently where vegetation was rankest and where moist loose soil made digging easiest. When such a place is encountered the large holes and piles of earth thrown out from the burrows are generally numerous.

Photograph by H. E. Anthony

SEWELLEL, OR SHOWT'L

A peculiar and little-known beast which occupies a family all to itself

The "colonies," however, are not large. A series of runways is inhabited by a single family, and there is no evidence that this animal is as social in its habits as, for example, the Prairie Dog, or the Meadow Mouse. One might be led to suppose many individuals were present because of the amount of earth thrown out and the numerous runways, but this is easily accounted for by the activity of the Showt'l. Traps set in the runways were almost always successful the first night, one and possibly two animals being caught. Thereafter traps set in

the same immediate vicinity yielded nothing for several days at a stretch, probably until some neighbors wandered over from nearby runways.

The burrow workings are simple. The plan is one or more long main runways opening to the surface by short side burrows at frequent intervals. The diameter of these runways is from six to ten inches, depending on the nature of the soil, and the floor is kept quite clear of loose dirt. Generally the runway follows any natural advantage, such as fallen logs, and here often the burrow is so shallow that it is but half its normal diameter into the soil, the log serving to cover it over. Where exit to the surface is made from a deeper runway the course of the short burrow is direct, and often the main runway can be readily seen by looking through its short length. Loose dirt is brought to these burrows and pushed out, being carried just far enough to be out of the way. The main runways, in many cases, may extend for more than 100 feet. The average depth below the surface is eight inches to a foot. The dirt is handled much in the same fashion as the Pocket Gopher works. A mass of loose earth is pushed ahead of the body by the chest and shoulders, the broad blunt head also being used to shove aside the dirt.

Showt'ls when caught in the trap without serious injury are very pugnacious, and at such times when two are brought together fight ferociously. They will bite at sticks or any objects thrust near them, and I imagine that under ordinary circumstances this pugnacity would serve to keep the inhabitants of a series of burrows few in number. Their resemblance to the Pocket Gopher, under similar conditions, indicates that the Showt'l may have the same surly home-life.

An animal caught in a steel trap by the leg but with no bones broken was kept alive to observe his habits. He was aggressive while in the trap and when brought near another captive, also uninjured, after the first tussle he created such a respectful attitude in the other prisoner that the latter strained at the chain to keep out of his reach. They were separated before either had been hurt, for the powerful incisors and strong jaw muscles are capable of giving deep wounds. While in the trap great care in handling the animal had to be exercised.

Before he had been in captivity twenty-four hours he was taken out to be photographed. A wire fastened to a hind leg prevented escape and he was put down in a spot resembling his home surroundings. After several determined efforts at escape, he suddenly stopped his struggles and grabbing a tender young shoot of the " elk brake" by which he was surrounded proceeded to feed as quietly and as unconcernedly as if he were perfectly free. He was quite touchy, however, and any sudden movement brought forth an attempt at freedom. He sat up a great part of the time, and if annoyed while in this attitude sparred like a Bear with his fore paws, showing a perfect control of his position.

So rapidly did he become tame that by nightfall of the first day he took young fern shoots from my hand and ate them while seated upon the window sill of my room, completely oblivious of my presence. His appetite was good and he ate a number of fern tips, generally selecting the youngest and softest from the handful offered him. The elk brake, that seems to be one of his main articles of diet, has many branching stems that bear the green foliage. The Showt'l clipped off an inch or two of the terminal stems, a single snip of the sharp incisors generally severing the small stem. Then holding this stem in his fore paws the animal passed the tender fronds back between the molars, and with a rather hurried crunching munched them down, mastication though rapid seeming to be quite thorough and audible as well. The posture of the animal was squirrel-like, with the back somewhat arched.

He drank large amounts of water when it was given him. He put his nose into the water and drank, and did not lap it up. This Showt'l was liberated on the bank of a small clear brook and as an experiment he was put out into a fairly deep pool. He swam ashore showing no fear whatever of the water, but evidently displaying no particular fondness for it. He looked very much like a slowly swimming tailless Musk-Rat. Despite the fact that the Showt'l has been described as being a water-loving animal, I do not think it ever swims from choice. This one spent some time after coming ashore in shaking out his fur and going over his sides and belly before he felt sufficiently comfortable to begin eating.

This animal washed his face after the manner of small mammals, reaching back with the fore paws onto his shoulders and hinder neck readily, the movements being short, quick dabs. When irritated he twitched the whiskers energetically and when most angry uttered a husky querulous note somewhat like a cough. He often satisfied his curiosity by sniffling and working his nose, and this member seemed to be very sensitive, for the slightest blowing upon it produced spasmodic starts. When aroused his eyes had a bright alert

appearance, but quickly took on a dull listlessness when the animal relaxed at ease.

His body was very hard and firm to the touch. When running loose on the floor and I put my hand upon him, he seemed to brace himself and become rigid at times. He could give sharp scratches when held, but did not seem to be able to squirm very effectually because of his short thick neck.

By the end of a week he had become so tame that he never threatened to bite. He seemed to accept the conditions as inevitable and, not showing any appreciation of caresses that some tame animals display, his attitude was one of complete indifference. He soon cut off the toes from the foot that had been pinched in the trap, but evinced no concern over the fact. No attempt was made to gnaw out of the box that kept him prisoner.

A pronounced musky odor is given off by the animal and is noticeable in skins some months old. It is very noticeable in a freshly killed animal, it having a strong penetrating quality, rather pleasant than otherwise. It recalls, most nearly, the scent of the Musk-Rat.

No very young Showt'ls were noted. This fact would indicate that there is a definite period of birth in the spring, and not an indefinite term extending over most of the early summer.

A variety of plants form the food. All of the more common plants and shrubs seemed to contribute, those noted especially being the thimbleberry, the large elk brake and the sword-fern, but in general any of the green leaved plants might be eaten. Leaves alone are eaten, and there was no evidence that the bark or roots were consumed. I was told by the farmers that the Showt'l not infrequently cuts piles of green vegetation and leaves it outside to cure into hay, taking it into the burrow presumably to store up, a proceeding like that of the Cony.

The Showt'l escapes a great deal of unwelcome attention from such enemies as hawks or owls, owing to the dense vegetation beneath which he works and also to his nocturnal habits. However, prowling animals use his burrows, for two Weasels were caught on successive nights in one runway, and I was told that Skunks were also caught in such runways.

H. E. ANTHONY.

Photograph by H. E. Anthony

SEWELLEL FEEDING

This animal is sometimes called the " Mountain Beaver ", hut while not afraid of the water, it does not take to it, as the Beaver does

Photograph by C. Reid

A BEAVER SUNNING

While the Beaver is one of the most industrious of animals, as well as one of the most ingenious, he has his lazy spells like the rest of us

THE BEAVER FAMILY

(*Castoridæ*)

BEAVERS have been placed in a family by themselves, because of certain well-known, distinctive features. Not only are their outward habits peculiar, but their anatomical markings are distinct. Rodents of this type are characterized by a massive skull. There are no postorbial processes. The cheek teeth are rootless, and on each side there are one premolar above and one below. The tail is broad and spatulate, and the hind feet webbed, to assist in swimming. Beavers are aquatic in habit, building their homes in the dams which they themselves have constructed. In this and in other work they display engineering skill of a high order. Economically also they are important. A very valuable trade in Beaver skins was carried on during the early days of this country, which continued until the animals became comparatively scarce.

BEAVER

Castor canadensis (*Kuhl*)

General Description.— Much the largest of American rodents, weighing up to 50 pounds. Head broad and rounded; nose blunt; incisors prominent and of a deep orange color; ears quite short and not projecting much above long hair of head; body very thick set and heavy; tail broad and spatulate, flattened horizontally, and, about one-half length of head and body; legs short; toes five on each foot; hind feet webbed and with claw of second toe double or divided; musk secreting anal glands; general color deep dark chestnut; paler below; pelage composed of dense short underfur and sparser outer fur of longer, harder hairs. Aquatic in habit.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{1-1}{1-1}$; Molars, $\frac{3-3}{3-3}$=20.

Pelage.— ADULTS: Sexes identical. Seasonal variation present but not especially conspicuous. General color brown to blackish-brown; hairs on upper parts dark brown at base, tipped with lighter brown or chestnut; underparts paler than back; sides of neck and rump light cinnamon brown; ears black; tail blackish-brown. YOUNG: Lighter than adults.

Measurements.— Total length about 42 inches; tail 16 inches long by 4.5 inches wide; hind foot, 7 inches.

Range.— From latitude 40° northward to Labrador and Hudson Bay region, and in western portion of range to the Arctic circle west to Cascade Mountains.

Food.— Twigs and bark of many trees, but principally bark of poplar and willow.

Remarks.— This highly specialized animal is placed in a family by itself, generally intermediate between Squirrels and the Rats and Mice. The Beaver may be easily known by its large size and peculiar tail. Variations in color, while not especially conspicuous, together with cranial characters and differences in size have resulted in some seven species and subspecies being formed.

RELATED SPECIES

Canada Beaver.— *Castor canadensis canadensis* Kuhl. Typical animal as described above. Northeastern North America, or northern tree limit, to United States, and west to Cascade Mountains.

Sonora Beaver, or Broad-tailed Beaver.— *Castor canadensis frondator* Mearns. Larger than Canada Beaver. Paler and with broader tail. Southward from Montana and Wyoming to Mexico along wooded streams.

Pacific Beaver.— *Castor canadensis pacificus* Rhoads. Largest of the Beavers. Tail long; color reddish-chestnut. Pacific slope, California to Alaska.

In the days of the early settlement of America the Beaver, including its races, was found from the Atlantic to the Pacific, and from the limit of trees in the far north of Canada to the Gulf of Mexico, wherever conditions were favorable. Today, however, thanks to the unstinted greed of man, this harmless animal has disappeared from the greater part of its former range, and over much of the remainder it is rare.

Within the last twenty years nature lovers and the better class of sportsmen have realized the great loss to the country which would result from the extinction of this valuable animal, and have succeeded in having it protected in many

States. The result is that it has become abundant in certain regions and is common in others. This is notably true in Colorado and Wyoming. In Maine and in the Adirondacks of New York State it is increasing rapidly. In Estes Park, Colorado, it is especially numerous, one holding of 1000 acres having a population of 600 or more.

With proper protection and well enforced laws regulating its capture there is no reason why the Beaver should not become again a source of pleasure and of profit over much of its early range.

Excepting Rats, Mice and Rabbits probably no rodent is so well known. The Beaver's industry has become proverbial; his fur is familiar to all, and his habits have made him a subject of much interesting literature.

By permission of the New York Zoological Society

AN ALERT BEAVER

The engineering feats of the Beavers in building two sets of dams and feeder canals are among the most remarkable achievements of the lower animals

The Beaver exceeds all other North American rodents in size. A fairly large one will weigh from thirty-five to forty pounds, and a few will go to fifty or sixty pounds. In shape the Beaver is squat and broad, resembling, in a general way, a Musk-rat, but is at once distinguishable from that animal by its broad tail. Two broad, chisel-like teeth in the front of each jaw enable him to cut wood with great ease and rapidity. These teeth are beveled on the inner surface and are self-sharpening, because the inner softer surface wears away faster than the harder outer surface. The fore-feet have five toes and are used as hands. The hind feet have the same number of toes and are webbed for swimming. In passing through the water the hind legs do the propelling, assisted sometimes by the sculling action of the tail, and the front legs are held against the sides.

The broad tail is not used as a trowel, as was formerly supposed, but is a rudder. Mr. Enos A. Mills states that sometimes mud is transported by being held between the tail, which is turned under and forward, and the under side of the body.

In these days of animal persecution the Beaver is nocturnal, but in localities where he is thoroughly protected he may be seen at almost any time during the day, particularly toward late afternoon. In a lake not far from Yellowstone Park the writer has often seen several Beaver at once swimming about. In Estes Park he has seen them at all hours of the day. One has only to sit quietly beside a Beaver pond to see one or more within a short time.

No mammal approaches the Beaver in the extent or the variety of the structures which it makes. He is the engineer of the mammal world. These works not only involve highly developed instincts, but, some writers believe, indicate a great degree of adaptive intelligence. Certain it is that the Beaver seems to use reason in modifying his structures to meet new situations.

Of all the Beaver's works his dam has at-

tracted the most attention. A fairly narrow valley is selected through which flows a small stream with a slowly moving current. Across this a dam is made of sticks, stones, mud and rubbish. The dam is usually from four to six feet high, eight to sixteen feet broad at the base and a foot or two wide at the top. The length may vary from a few feet to several hundred. The longest observed by the writer is in Estes Park, and is 1040 feet long. Above it and below it are series of shorter dams. These structures are by no means always convex upstream, as some of the older writers assert, but often bend down stream, and the longer ones are frequently zigzag. Secondary dams are often built below the first. These are apparently for the sole purpose of backing up the water against the first dam, and so relieving the pressure — an astonishing proof of the animal's intelligence.

In making the dam mud is used, reinforced by sticks from four to twenty feet long, and from two to six inches in diameter. These are laid approximately parallel to the stream flow, with the larger ends upstream. They are held in place by piling mud and stones on these ends. More sticks are piled above the first and so on until the required height is reached. The mud is taken from in front of the dam and deepens the water at that point. Sometimes simply a barrier of sticks is made through which the water passes freely. In the course of time, however, floating material lodges against the sticks and completes the dam.

As time goes on the sticks decay; more and more mud is added by the Beaver; grass, willows and alders get a strong foothold and we have a solid structure of earth and rocks held firmly together by vegetation. Strong as they are these dams are often broken by flooded streams, but are quickly repaired by the ever watchful builders.

Structures which cost so much work as these must be of much value to the Beaver. Two purposes are fulfilled. Usually the dam forms a pond deep enough so that the openings into the Beaver houses, or into burrows in the bank, are far enough under water to protect their owners against enemies. The center of the pond provides a storage place for the large supply of green sticks collected for the winter food. A third use is to extend a body of water toward a group of trees which the animals are to cut and float to their homes.

Photograph by C. Reid

BEAVER SWIMMING

As has been indicated, Beavers live in houses or in holes in the banks of ponds. The houses are made of much the same materials as the dams, and are of various sizes according to the number of individuals living in them. They are conical, and may be eight feet high by forty feet in circumference. Inside, and just above the water level, is a large chamber which is connected with the outside by a tunnel opening under water. The chamber walls are about one foot thick and, when frozen solid, defy the attacks of the Beaver's fiercest enemy, be it Bear or Wolverine.

When the home is a burrow, the opening is under water and a tunnel extends diagonally for several feet, sometimes thirty, into the bank, and ends in a chamber three or more feet in diameter and about one foot high.

In summer Beavers travel away from home to a considerable distance, visiting other colonies and exploring other streams, and the houses are

used less and the burrows more. When harassed they are less likely to make houses.

Of all the works which show the skill of the Beaver, many regard his canals as showing his intelligence to the fullest extent. Many animals build homes, and the dam has a direct connection with the safety of the Beaver home, but the canal has no direct connection with either. It is a structure planned with a definite end in view, that is, the greater ease in transporting food. When all suitable trees near the borders of the pond have been cut, it becomes increasingly difficult to get sticks from the source of supply to the storage pile in the home pond. At the expenditure of much energy the stick must be rolled, pushed and dragged for a distance, in some cases, of a quarter of a mile or more. To avoid this, when the ground is suitable, a colony of Beavers will often dig a canal in the direction of a grove of trees. According to circumstances such a canal may be from a few feet to several hundred in length. Its depth varies from about fourteen inches to over three feet, and its width is two feet or slightly more. Beavers will on occasion dam the canals and also construct lateral ridges to direct surface water. This further evidence of engineering skill would be astonishing were it the only trait of this extraordinary animal.

Canals are sometimes dug in the bottoms of shallow ponds. These make travel and transportation easier in times of low water, and afford avenues of travel when the ponds are frozen nearly or quite to their bottoms.

The food of Beaver has been indicated already. It is the bark of many kinds of deciduous trees, especially aspen, willow and birch. Roots of water-lilies, grasses and even berries are also eaten, but bark is the staple. Evergreen trees are sometimes cut for structural purposes, but the bark is not eaten.

Since the Beaver cannot climb, he must fell trees in order to get any large supply of food without traveling to great distances. This he does by gnawing, for which his four great chisel-shaped front teeth are well adapted. A tree two to eight inches in diameter is usually selected. The worker sits bolt upright with his tail stretched out behind, as a prop, and proceeds to cut in such a manner that, just before the tree falls, the cutting resembles the central part of an hour-glass. When once seen it can never be mistaken. As the tree is about to fall the Beaver woodchopper slaps the ground with his tail as a warning to others, and all get to places of safety. The branches are trimmed off next, the trunk cut into lengths of from three to six feet or more, and are dragged and rolled to the pond or canal through which they are floated to the food pile near the house. Here they are sunk to the bottom and held there by a little mud and by other pieces piled on top. The diameter of the trees cut usually is not over eight inches, and the record is thirty inches, but the writer has seen three narrow-leafed cottonwood trees in one group, varying from twelve to fourteen inches in diameter, all of which had been felled. Only branches less than eight inches in diameter, however, had been used.

The Beaver, contrary to common report, does not always succeed in making a tree fall in a given direction. Many pictures are extant showing trees in helter-skelter position.

After the bark has been eaten during the winter the sticks are used for house and dam building, if needed.

Beavers are monogamists and, apparently, mate for life. Mating takes place in February, and the young are born in May. In a month they can live on solid food, and at two years of age are capable of mating. The number of young in a litter averages about four, but it may be any number from one to eight.

The following pleasing glimpse of the Beaver at home is given by Dan. J. Singer: "As we were passing a small pond of perhaps 100 yards in diameter, I caught a transient glimpse of a Beaver through the thin blue ice as he darted into the tunnel which led to his house. This low-domed house (which looked very much like the house our musk-squash builds) was built of mud, turf and sticks cleverly interwoven, and rising about three or four feet above the surface of the ice. At one end of the pond they had their customary dam, as well as a great store of food to guard against the winter's famine. At a point in the dam they had deposited this food supply, which consisted chiefly of willow branches cut into convenient lengths. At feeding time one slips out of the house and swims down through the pale amber water to the brush-pile, selects a suitable stick and returns to dine on its tender bark. And so, all through the long, savage winter, the little chaps live, play and feed — all below the frozen upper world.

"The Beavers are not without their enemies, however, and, perhaps, the most feared is that long, squat, shambling animal, with a triangular head and two cruel leering eyes — the Wolverine or Glutton. With just about six rakes of his rascally claws he could demolish the entire house, once the ice has ceased to protect it, but presto!

Photos by Enos A Mills and C. Reid

THE BUSY BEAVER AND HIS WORKS

The photographs are of a beaver house (upper left); trees felled by beaver (upper right;) a beaver dam (lower right); and one of these clever rodents (lower left)

the little chaps, whisking out into the friendly water, are not to be caught by such a trick.

"Then there were those gray, drifting shadows that lurked near the pond when the little chaps were busy in the spring repairing the dam — those round-eyed, moon-faced Lynxes, gaunt with famine after the scourge of winter, which come stealing on soft-padded feet and bellies to the snow, just within springing distance. The wary sentinel Beaver brings down his wide, flat tail on the water with a loud smack — a signal to every Beaver to vanish."

In many parts of the West there has been bitter opposition to the conservation of the Beaver because of the damage it does to fruit trees. By making extensive ponds, also, the Beaver sometimes kills a great quantity of very valuable timber. In Ontario several years ago this backing-up water by the Beaver and the killing of valuable timber became such a serious matter that the province authorized the destruction of several hundred of the animals.

However, the Beaver is constantly proving that his good deeds outweigh the bad. In the arid plains irrigation plays a very important part. A constant supply of water is necessary for this. The Beavers in the mountains, by building a series of dams in the valleys, form ponds and willow-covered marshes, which retain the extra waters of the melting snows and spring rains, and give it out gradually during the summer.

Beavers should be allowed to exist simply for the interest they add to the life of mankind, to say nothing of their economic value. Beaver skin has brought more money than that of any other animal, unless it be the Fur Seal. So common was its fur in early days, and such a standard value did it have, that in Canada for many decades it was a medium of exchange among the Indians, white trappers and traders. In the latter part of the eighteenth century American companies exported about 150,000 skins annually and the Hudson Bay Company 50,000 more. The fortune of the Astor family had as its basis chiefly the trade in Beaver fur. This interesting fact is tacitly implied in the image of the Beaver which appears in the tile work of the Subway station at Astor Place, New York.

J. M. Johnson.

WESTERN, OR YELLOW-HAIRED PORCUPINE

THE PORCUPINE FAMILY

(Erethizontiidæ)

THE Porcupines belong to a separate family from the other North American Rodents—their outward dress alone serving to distinguish them from other animals, were there no other marks. They are thick-set Rodents, having long sharp spines loosely attached to the skin. The skull has a short blunt facial portion. The molars are more or less completely rooted.

The short thick tail, short legs, and plantigrade feet are also characteristic of our native species, although foreign types differ, one kind in South America having a long tail for clinging, like our Opossum. The spines barbed at the tip are scattered among the hair, pointing backward, but may be elevated by muscular contraction. They are so loosely set that they readily stick to other objects, but the animal has no power to discharge them. The Porcupine family in North America falls into two fairly well-marked groups.

CANADA PORCUPINE

Erethizon dorsatum *(Linnaeus)*

Other Name.—Quill Pig.

General Description.—A very large rodent with thick-set body and pelage containing numerous sharp barbed spines, exceeded in size among American rodents only by the Beaver. Head blunt and rounded; facial region short; ears of moderate height; body very stout and thickset; tail about one-fifth length of head and body, thick and muscular; legs short; four toes on fore feet, five on hind feet; lips hairy; pelage composed of three elements, a short, fairly soft underfur, very long coarse hair forming the outer fur, and numerous stout spines set loosely in skin and barbed at tips. These spines have lost all resemblance to hairs. Coloration dark.

Dental Formula.—Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{1-1}{1-1}$; Molars, $\frac{3-3}{3-3}=20$.

Pelage.—Adults: Sexes identical. No marked seasonal variation. General coloration blackish; long hairs of dorsal surface yellowish-white at tip; quills white with dark tips, ordinarily fairly well concealed by the long hairs; underfur blackish-slate; quills longest on lower back and tail; quills not found on under surface; below brownish-black; tail colored like back. Young: Similar to adults, spines shorter, and light tips to hairs not so conspicuous.

Measurements.—Total length, 35 inches; tail, 5.5 to 6.5 inches; hind foot, 3.5 inches. Weight, 30 pounds.

Range.—From 40° north latitude in eastern North America to Hudson Bay, northwest to Arctic circle and Alaska.

Food.—Chiefly bark and twigs of willow, hemlock and other trees. Decided craving shown for salt.

Remarks.—There are six varieties in North America falling into two fairly well-marked groups differing mainly in coloration; those of the Canadian Porcupine group being yellowish-white, those of the Yellow-haired Porcupine group being a greenish-yellow.

Related Species

Canada Porcupine.—*Erethizon dorsatum dorsatum* (Linnaeus). Typical animal as described above. From 40° north latitude in eastern North America to Hudson Bay northwest to Arctic circle and Alaska.

Yellow-haired Porcupine, or Western Porcupine.—*Erethizon epixanthum epixanthum* Brandt. Similar to Canada Porcupine, but long hairs with greenish-yellow tips, and quills yellowish with black tips. From upper Missouri south to New Mexico, west to the Pacific, northward from California to Alaska, probably the limit of trees.

Anyone who has traveled in the woods of the northern United States is familiar with the Porcupine, or Quill Pig. In appearance he is not attractive. His shape is not unlike that of a Beaver covered with long stiff quills. His tail, too, is broad and flat, but not so wide as that of a Beaver. This also is quill covered. The dull expression of his eyes is indicative of a thoroughly stupid animal.

As in the case of so many animals, the Porcupine is more common in some localities now than it was some years ago. In the Adirondacks when

deer were formerly hunted with hounds the latter would often attack a Porcupine. A mouthful of quills and a dog rendered useless for a long time was the result. The hunters swore vengeance on the cause of their troubles, and shot every Quill Pig they saw. In Canada the

PORCUPINE CLIMBING

The Porcupine never hurries, whether on the ground or up a tree

Indians also decreased their numbers by killing them for food. Now all is changed. A law protects them in Canada, and hounding deer is not allowed in most parts of the United States. The hunters also fear to frighten the deer by shooting at other animals, and thus the Porcupine escapes.

Although found in deciduous and in mixed forests, the Porcupine prefers the evergreen woods. The hemlock is his favorite food tree, and, in winter, he subsists almost entirely upon the bark of this and other trees. In summer, however, he will eat almost any vegetable matter, and will go to considerable trouble to get lily-pads.

In one respect, however, the Porcupine is not a strict vegetarian. He will brave all dangers to get salt, or anything that has the suggestion of a salty flavor. Repeatedly during the night he will return to a camp from which he has been driven, in order to gnaw flooring, door jams, ax-handles, or any article which has been handled.

Some years ago the writer, with a party of four or five persons, was traveling in the Adirondacks when he chanced upon a deserted camp composed of several tents made of canvas stretched over wooden frames. On entering one of these, three Porcupines attempted to pass out. They were driven back with sticks, but repeatedly tried to get past the door-keepers. Finally one of them climbed a diagonal support, over which the canvas was stretched, in order to reach the ridge-pole. The canvas, however, hindered him, and he soon fell, landing in a nail-keg. This incident suggested a method of capturing them all alive without injury from the quills. Several large grain sacks, filled with hay, were lying about. They had served as pillows. One of these was emptied and a member of the party held it open under the diagonal support. Then some of us drove a Porcupine up the support until the canvas prevented further progress, when the animal fell into the open mouth of the grain sack. This was repeated until all three were captured.

This incident illustrates two traits of the Porcupine. First, it will go directly toward an enemy, if it must, in order to reach a familiar place of refuge. Second, the fact that flooring, tent supports, broom-handles, and other things, with which human flesh had come in contact, were much gnawed showed its taste for salt.

Except during the coldest weather, the Porcupine does not hibernate. He may stay in his "den" until the worst is over, but a slight increase in temperature will bring him out, and his wanderings may be traced by his tracks in the snow and by chips and pieces of bark under the trees where he has fed. Nor does he confine himself to the night hours for roaming, but may be seen at all hours of the day. Once he has gotten into a favorite tree, he is not likely to leave it until he has exhausted its food possibilities.

Although a Porcupine will retreat when it can, it will often sit still, if its place of refuge is too far away. When attacked it does not roll itself into a ball, as has often been stated. It does, however, arch the back, erect the quills, put the

head under a log or root, if one happens to be handy; otherwise it puts its nose between its forepaws. Then if approached closely, or poked with a stick, it waves its tail defiantly. Woe betide the animal which is rash enough to get in the way of that tail. Wherever it strikes flesh the quills penetrate, stick, and cause great pain. More pain will come later when an attempt is made to pull the quills out. The point is very sharp, and below it are hundreds of little barbs pointing backward. This means that they must often be cut out of the flesh or the points broken off in it.

lieved to be the only enemy that has solved the problem of safe attacks. It kills the Porcupine by quickly turning it over, and slitting its abdomen.

Since the Porcupine does not have to depend upon flight, alertness, subterfuge or fight to escape its enemies, but only upon a protective covering, its mental qualities are not high. Indeed it is one of the dullest animals. Use is the mother of progressive development, and disuse leads to degeneration. This law is well illustrated also in the turtle, armadillo and echidna.

YELLOW-HAIRED PORCUPINE

This western type has a wide range, having been found above the timber-line on some Colorado mountains

In the latter case these points often "work through" the part injured. The quills separate easily from the skin of their owner, but he *cannot throw them* at an enemy as was formerly stated.

Panthers, lynx, bears, foxes, wolves, and other flesh-eaters fall victims in their attempts to make a meal of this armored rodent. The mouth and throat of these victims become so sore and swollen from the quills that the animal cannot eat, and soon perishes. The Fisher is be-

Mating in the northeastern United States takes place in the autumn, and the young are born about the first of May. Merriam states that they are actually larger, and relatively thirty times larger, than the young of the Black Bear. From one to four is the number in a litter. By autumn they are able to shift for themselves.

The *Yellow-haired*, or *Western, Porcupine* is so much like the eastern one in general appearance that a casual observer would not see any difference. He has the same spiny covering, the

same stupid eyes, and the same indifferent attitude toward his enemies. The chief difference is in color, the western type being of a greenish-yellow hue.

The range of altitude of this western cousin is remarkable. The writer has seen a dead Porcupine in the sagebrush desert of the Wind river valley in Wyoming at an altitude of 6000 feet, and a live one above tree line, 12,400 feet, on the top of Flattop Mountain in Colorado. It was a great surprise to see him ambling along on this wind-swept, cold, boggy surface. His food must have been the bog willows which were only a few inches high and widely scattered. Perhaps he had only strayed for a few hours to the point where he was seen. Groves of jack-pine and other conifers grew several hundred feet below, and in these he must have had his home.

Another specimen was found at an altitude of 8500 feet, in Estes Park. He was in a wood road, and hurried toward a wall under the tree beside the road. We wanted a photograph, and grabbing long sticks, ran to him and, by dint of much prodding and shoving, managed to keep him out of the deep shade long enough to get two good exposures. His constant endeavor was to get his head under something, but never once did he try to curl into a ball.

The remains of a Porcupine in the Wind river valley were discovered in a curious and laughable way. A member of the party with whom the writer was traveling on horseback through western Wyoming, leaned over, cowboy fashion, to pick up a handkerchief from the ground without dismounting. A loose saddle-cinch allowed the saddle to turn, and the rider suddenly found himself on the ground, sitting squarely upon the skin of a dead Porcupine. Although the animal was dead, the quills were just as much alive and full of vim as ever. When the rest of the party rode up, the unfortunate man was busily engaged in pulling out the quills, meanwhile expressing a pointed opinion about all Porcupines in general and this one in particular.

The Indians value the Porcupine as food and as a source of the quills which the women use for various kinds of fancy work. The white man, however, has made little use of this peculiar animal. It has, however, saved the life of more than one hungry man lost in the wilds, as it is the only edible animal that can easily be killed without firearms. J. M. JOHNSON.

YELLOW-HAIRED PORCUPINE

A western species, photographed in Estes Park, Colorado

THE FAMILY OF RATS AND MICE

(*Muridæ*)

THIS is the largest of all families among the mammals. It numbers a wide variety of individuals. They are generally very small rodents with lower incisors compressed; no premolars; molars rooted or rootless; and tail generally nearly naked and scaly.

Dr. Coues described the members of this family as "a feeble folk, comparatively insignificant in size and strength, holding their own in legions against a host of natural enemies, rapacious beasts and birds."

Few of us have any idea of the large number of these little beasts. They are found almost all over the world, far outranking other forms in number. In North America nearly one-fourth of all our four-footed animals belong to this mighty family. There is, in fact, no escaping them. They invade our pantries, our barns, our fields, our plains, and our woodlands. There are special types adapted to nearly every environment, as for example the Wharf and Sea-going Rats.

The family is therefore of great economic importance to man; and its members — some of them at least — may be fittingly described as the greatest travelers among mammals. Probably not a ship enters or leaves our ports that does not have among its unlisted passengers some enterprising Rat or Mouse. Dr. Rae some years ago captured at York Factory, on Hudson Bay, a specimen of the Common House Mouse which had been brought from Europe; and the Brown Rat has been seen on liners between San Francisco and Honolulu.

In size the numerous species comprising the family range from the Musk-rat to the pygmy Harvest Mouse. Every country has its own particular species, and North America has many that are native. The fecundity of Rats is astonishing. In the temperate parts of the United States, Rats breed three to five times a year; the Meadow Mouse brings forth four to six litters. That Rats are the disseminators of disease has been established beyond question. Not only do they convey the bubonic plague, but they are known to spread trichinosis among swine. As they move about in all sorts of filth, it is obvious that they must be active agents in the propagation of the germs of many other diseases. The Brown Rat, the Roof Rat, and the Black Rat are, however, all "introduced" Rats. The native American Rats are of a totally different character. Rats like the Wood Rat are not only clean in themselves, but their food is of an unobjectionable nature; and, as will be shown later, their flesh is both wholesome and palatable.

In habits Rats and Mice are for the most part nocturnal. Many species live in burrows or tunnel-like runways on the surface of the ground among the grass roots and seldom venture forth into the light. Other species like the Musk-rat are aquatic and have become excellent swimmers. While this family is popularly known as Rats and Mice, the two names refer to the same type of animal, the distinction being chiefly one of size. As the sizes approach each other, there is some confusion of terms, which is further heightened by the use of such terms as Lemming, Lemming Mouse, and Vole. However, by dividing the present numerous family into fairly well-defined groups, we shall be aided in our study of this industrious and ubiquitous rodent.

HOUSE RAT

Epimys norvegicus (*Erxleben*)

Other Names.— Norway Rat, Brown Rat, Gray Rat, Barn Rat, Wharf Rat.

General Description.— The common Rat to be seen about cities. Head of normal size; nose pointed; muzzle naked at extremity; ears and eyes rather large; body moderately large; tail long, about half of total length, nearly naked, with rings of overlapping scales; legs of normal proportions; hind foot with six tubercles on the naked sole; no cheek pouches; fur rather coarse than soft.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical, seasonal variation slight. Normal coloration grayish-brown above; dirty grayish-white below; upper surface with more or less black hairs especially along the dorsal area; feet soiled grayish-white; tail dusky above and rather lighter below, though not distinctly bicolor. Hair on tail short and so sparse that the annuli may be plainly seen. Young: Grayer than adults.

Measurements.— Total length, 15.7 inches; tail vertebrae, 7.5 inches; hind foot, 1.6 inches.

Range.— Practically cosmopolitan. In North America found in nearly all cities and the larger settlements.

Food.— Omnivorous to a large extent.

Related Species

Norway Rat.— *Epimys norvegicus* (Erxleben). Typical animal as described above. North America about the habitations of man.

Black Rat.— *Epimys rattus rattus* (Linnaeus). Size smaller than Norway Rat; tail longer, more than half the total length; color above plumbeous-black, below slate-black. Found only in scattered localities, mainly in the southern and southwestern United States.

Roof Rat, or Alexandria Rat.— *Epimys rattus alexandrinus* (Geoffroy). Smaller than Norway Rat, about size of Black Rat; tail very long, more than half total length; color reddish-brown above, yellowish-white to whitish below. Found in scattered localities.

Photograph by West Va. University Experiment Station

HOUSE RATS IN TRAP

The Rat will fight viciously when cornered, and has been known to put the cat to flight

The common Rat is an "introduced" guest, as its other name "Norway" indicates, and has somewhat overstayed its welcome. It was brought over to America in some of the earliest ships, and thus may trace its lineage not only to the Mayflower, but perhaps even further to the voyages of the Norsemen. Evidence shows that it reached our shores both by way of the Atlantic and the Pacific.

There are three related species that have been thus introduced. One of the first to come was the Black Rat and also at an early time, the Roof Rat. However, with the advent of the Norway Rat, both the others were driven out, and today are found only in out-of-the-way places not yet settled by the Norway Rat.

These introduced Rats may be readily told from our native Rats by their general appearance, such as the scaly, ringed tail and the coloration above described.

The Norway Rat is perhaps the most detested of all mammals. It is a born thief; it feeds on nearly every kind of vegetable or animal food. It will kill poultry and devour eggs; it will ravage grain fields and carry off to its hole grain, potatoes, vegetables and similar spoil. Its powerful teeth enable it to gnaw through stout boards and partitions in a very short time. The writer has seen a lead pipe that was gnawed through by these Rats, causing an escape of gas which led to a serious explosion.

The peculiarity of this Rat is that it is destructive everywhere. In the fields it digs the seed as soon as it is sown; it eats the green growing grain; and when the crop is harvested it follows it into the stack, the granary, the warehouse, and the mill. In the greenhouse it attacks the bulbs, stems, leaves, and seeds of flowers; it will climb blackberry canes and grape-vines to obtain the fruit; and in imperfectly protected hen houses it will take both eggs and young chicks from under sitting hens. That many of these depredations are not prompted by need of food is evident.

In this connection an experience of the present writer may be of interest. On the occasion of moving into a house in Montclair, New Jersey, toward the end of April, a few years ago, the furniture vans, coming from a distance, did not arrive in time for the books to be placed on the library shelves. The books were therefore placed for the night on the floor of an empty upper room. In the morning it was found that during the night a Rat, or Rats, had entered the room and attacked a number of volumes which had leather backs. No books with bindings other than leather were touched. Now the weather was mild and spring-like, and there was nothing to suggest that food was scarce. Why did the Rat attack these particular books? It should be mentioned that the meal apparently was too much for the intruding rodent, for during a long occupancy of the house it was never heard or seen again. Also, in justice to the authors we shall not mention the titles of the volumes!

Ernest Ingersoll states that Rats "often gnaw the hoofs of horses until the feet bleed. They have been known to kill young lambs and pigs,

Photograph by H. T. Middleton

AN UNWILLING POSE

A flashlight, in which the Rat itself may be seen pulling the trigger

and to attack very fat hogs and eat holes in their bodies, causing death. Farrowing sows have been killed by Rats gnawing their teats until blood poisoning resulted." A prominent American broker bears today the mark where a Rat bit him on the nose when he was an infant and asleep. Since the introduction of lighting by electricity, there have been numbers of fires caused by Rats gnawing the insulation.

The Brown Rat is very prolific. It begins to breed when very young, has several litters a year, and produces eight to fourteen young at a birth.

Extremes of temperature do not seem to bother this rodent. Mr. Wilfred H. Osgood in his "Natural History of the Cook Inlet Region, Alaska," states that "a few Norway Rats have

established themselves about the wharf and stores at Sunrise."

The *Black Rat* seems to have been the first of the foreign Rats to take up its abode among us. Of Oriental origin, it made its way into Europe and was thence conveyed to Spanish America, probably in the sixteenth century. It spread northward; but with the introduction of the Norway Rat, the black species was gradually driven out by its more savage relative. It is still numerous in the West Indies and in Central and South America. This species does not burrow under foundations as the Brown Rat does. It breeds three or four times a year, and there are usually five or six young in a litter.

By permission of U. S. Biographical Survey

BLACK RAT

A sketch showing the powerful neck and head, and other distinguishing marks of this unwelcome immigrant

The tame White Rats which children keep as pets are a variant of this species.

The *Roof Rat* originally came from Alexandria, Egypt, or the neighboring countries. It resembles the Brown Rat, but is grayer in the upper parts, and its abdomen and feet are of a yellowish-white. Like the Brown Rat it is a wharf Rat, and is moreover a very good climber. It is found on ships, and has obtained a footing in some of the southern States. Two specimens were caught on the Guadalupe river, at Ingram, Texas, in 1902, whose presence in a place so far in the interior is thus explained by Bailey: "The Guadalupe river is subject to violent floods, sometimes rising suddenly to fifty feet above low water. The enormous heaps of drift rubbish deposited along the bottom and in the branches of trees have evidently furnished a highway for the distribution of the Rats from the coast up the river. The two individuals secured were living in these drift heaps. One was caught on the ground at the edge of a drift heap; the other, on a pole reaching across from one heap to another."

ALBERT PORTER.

EASTERN WOOD RAT

Neotoma floridana (*Ord*)

Other Names.— Pack Rat, Trade Rat, Brush Rat.

General Description.— About the size of the House Rat but with a more hairy tail. Head pointed; eyes and ears large; ears thinly haired; whiskers very long; body only moderately thick set; tail long, about half of total length, well clothed with short hair; legs fairly long, slender; general color above plumbeous, below white; hair rather long. Of nocturnal habit but often seen in the daytime as well; of inquisitive temperament.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— ADULTS: Sexes identical. Seasonal variation slight. Above, plumbeous or slaty-black, darkest on dorsal region, mixed with dark-brown and pale yellowish-brown, the latter predominating on flanks; feet and underparts clear white; tail above dusky, below white, sharply bicolor; tail well haired but not

bushy. YOUNG: Slate gray above, white below; tail not so well haired.

Measurements.— Total length, 15.5 inches; tail vertebrae, 7.5 inches; hind feet, a trifle over 1 inch.

Range.— South Atlantic and Gulf Coast and lower Mississippi Valley.

Food.— A large variety of seeds, grains, leaves of different plants, and other vegetable matter.

Remarks.— Thirty-four species and subspecies of Wood Rats are found north of the Rio Grande, most of them belonging to the round-tailed or narrow-tailed section of the genus.

RELATED SPECIES

Eastern Wood Rat, or Eastern Pack Rat.— *Neotoma floridana floridana* (Ord). Typical animal as described above. Atlantic Coast region from South Carolina to Florida.

Pennsylvania Wood Rat.— *Neotoma pennsylvanica* Stone. Tail less than head and body; ears moderately large. Southern New York to northern Alabama, westward to Kentucky and Tennessee.

Small-footed Wood Rat.— *Neotoma micropus micropus* Baird. Southeastern Colorado and southern Kansas south through Oklahoma and central Texas.

Dusky-footed Brush Rat.— *Neotoma fuscipes fuscipes* Baird. Size large; tail long; ears large; upper surface of hind feet dusky; ankles blackish. Pacific Coast region from San Francisco Bay north to Salem, Oregon.

Desert Brush Rat.— *Neotoma desertorum* Merriam. Pelage very soft; tail short, brownish buff above with mixture of black hairs. California, Nevada, Oregon, Utah, Colorado in desert areas.

White-throated Brush Rat.— *Neotoma albigula albigula* Hartley. A large dark form; grayish-yellow brown above, thickly lined with black. Northern New Mexico, central Texas, western Arizona.

Brushy-tailed Wood Rat.— *Neotoma cinerea cinerea* (Ord). See special synopsis below.

The group of Wood Rats, *Neotoma,* is a very large one and in general is distributed over nearly all of North America. The Wood Rat may be easily recognized by the clear white underparts contrasting noticeably with the slaty upper parts, as well as by the long densely haired tail, these characters being sufficient to separate it at a glance from the Norway Rat, the only rodent with which it could be confused.

Being a rather adaptive group Wood Rats are found living not only in timbered areas but on the desert as well, and thus, as might be expected, some variation in coloration is encountered. In addition a somewhat distinct subgroup or subgenus of these Rats having tails decidedly more bushy is found in western North America.

The Wood Rats are in many respects the most interesting of all; and some of them are really handsome animals. They are not to be associated with the common Brown or Wharf Rat. When the word "rat" is mentioned, most persons at once think of those filthy stable-haunters and plague-conveyors introduced from the Old World. Wood Rats, however, are of a different genus, indigenous to America, and are clean, velvety-furred animals of exemplary habits. They have even been declared to be good eating. Mr. Vernon Bailey relates that when he was gathering specimens in Missouri, three or four of those collected were cooked at the ranch where he was staying and were pronounced "better than Gray Squirrels. The meat was very tender and of good flavor, with no trace of the external musky odor peculiar to Wood Rats."

Some Wood Rats live in woods and swamps; some are to be found, as in Nebraska, from the bases to the tops of mountain ridges; some make their home in rock ledges or broken cliffs. The *White-throated Wood Rat* is a cliff-dweller, always keeping to the rocks.

A characteristic of all the species is the house which they construct. In the selection of a site some of these animals show considerable intelligence. The Baird *Small-footed Wood Rat,* for instance, has its favorite building site "in and around a bunch of the blades of the prickly pear, where the stack of rubbish — cow-chips, sticks, bark, leaves, stones, bones, pieces of metal, dishes, leather, rags, or any other available material, well salted with bits of cactus and other thorny things — is often built into a dome four or five feet high." Most of these houses are so well protected with thorns that they are rarely molested, even by the tough-hided Badger. But "how Rats themselves can run over these houses and along the trails strewn with cactus spines and never show a scratch on the bare pink and white soles of their feet is a mystery."

Some of these Rats give evidence of considerable mental capacity. The common Wood Rat, for instance, shows such ingenuity in disposing of stolen property that its pranks, attested by unexceptionable testimony, are almost beyond belief. Dr. Hornaday humorously says of it that "seemingly its chief object in life is to play practical jokes on mankind." In the *American Journal of Science* for 1877, Mr. A. W. Chase thus relates his discovery of a Wood Rat's nest in an uninhabited house in Oregon: "This house was left uninhabited for two years, and, being at

some distance from the little settlement, it was frequently broken into by tramps who sought a shelter for the night. When I entered this house I was astonished to see an immense Rat's nest on the empty stove. On examining this nest, which was about five feet in height, and occupied the whole top of the stove (a large range), I found the outside to be composed entirely of spikes, all laid with symmetry, so as to present the points of the nails outward. In the center of this mass was the nest, composed of finely divided fibers of the hemp packing. Interlaced with the spikes we found the following: About three dozen knives, forks, and spoons, all the butcher knives, three in number, a large carving knife, fork, and steel, several large plugs of tobacco; the outer casing of a silver watch was disposed in one part of the pile, the glass of the same watch in another, and the works in still another; an old purse containing some silver, matches, and tobacco; nearly all the small tools from the tool closets, among them several large augers . . . all of which must have been transported some distance, as they were originally stored in different parts of the house. The articles of value were, I think, stolen from the men who had broken into the house for temporary lodging. I have preserved a sketch of this iron-clad nest, which I think unique in natural history."

Another characteristic of many of the species is the propensity to store food, often conveyed from a distance. Mr. H. P. Attwater, when collecting the subspecies which bears his name, tore down a number of its houses. "In one of the underground passages at the nest were stored away about three dozen bunches of wild grapes; also many acorns and black haws. In another nest were about two dozen small mushrooms. All the heaps in the cedar brakes contained large stores of cedar berries, most of them with the outside pulp eaten off and the seeds eaten out. What an immense amount of work is necessary before enough can be obtained for a meal, as probably a thousand would be required."

Most of the species are nocturnal, but some, as the Baird Rat, are both nocturnal and diurnal. As soon as darkness falls, "if the cabin of the woodsman is near its haunts, it will be overrun with these animals, and they will be seen on floors and shelves diligently seeking food. In such places they become very bold, climbing upon the bed, and racing over the body of its sleeping occupant."

BRUSHY-TAILED WOOD RAT

Neotoma cinerea (*Ord*)

Other Names.— Brushy, or Bushy-Tailed Pack Rat, Trade Rat.

General Description.— Appearance very much like Eastern Wood Rat, but size larger and tail much broader and bushier. Ears large; body large; tail broad, squirrel-like; hind feet large; whiskers prominent; hair rather long; general color mixed yellowish-brown and black, below white.

Dental Formula.— Same as that of Eastern Wood Rat.

Pelage.— Adults: Sexes identical. Seasonal variation occurring, but not especially noteworthy. Above, mixed yellowish-brown and black with more buff and less black on sides; below, white, contrasting markedly with color of sides; hairs of underparts ashy at base except on breast; feet white; ankles dusky; tail rather darker on upper side than the back, lacking the yellow tints, below white except near base where it is brown; hairs of tail a full inch in length. Young: Above, slate-gray thickly mixed with black; below, ashy-white; tail with hairs shorter than in adults.

Measurements.— Total length, 15 inches; tail vertebrae, 7 inches; hind foot, 1.7 inches.

Range.— Rocky Mountain region from southern British Columbia southward into Arizona and westward into central Nevada and California.

Food.— Seeds and green vegetation.

Remarks.— This subgroup has not become so finely split up as that of the Round-tailed Wood Rats and there is but the one species, which has, however, eight subspecies which differ chiefly in coloration and cranial characters.

Related Subspecies

Brushy-tailed Wood Rat.— *Neotoma cinerea cinerea* (Ord). Typical animal as described above. Rocky Mountain region from southern British Columbia south to northern Arizona and westward to central Nevada and the Sierra Nevada range in California.

Western Brushy-tailed Wood Rat.— *Neotoma cinerea occidentalis* (Baird). Tail long; ears large; coloration dark. Pacific Coast region of Oregon and Washington eastward to plains of central Idaho.

Yellow Brushy-tailed Pack Rat.— *Neotoma cinerea orolestes* (Merriam). Size large; above buffy ochraceous. Rocky Mountains, Colorado, Wyoming and New Mexico.

Dakota Brushy-tailed Pack Rat.— *Neotoma cinerea rupicola* (Allen). Size small; above creamy buff lined with black; underparts pure white to base of hairs. Bad Lands, South Dakota through southeastern Wyoming and western Nebraska to northeastern Colorado.

Although a member of the same group as the Eastern Wood Rat, the Brushy-tail deserves separate mention. In its outer markings it is seen at a glance to be noticeably different. This is a mountain-living Rat, living in timber and generally in rocky localities.

The Brushy-tailed Wood Rat is far handsomer than its cousins of the genus *Neotoma*. Instead of the common, ordinary tail, scaly, long, and naked, it has one resembling that of the Squirrel, well covered with hair, and bushy to boot. There are several forms found in British Columbia, western Canada, the Pacific coast region of Oregon and Washington, eastward to the plains of central Idaho. Its habits are similar to those of the other Wood Rats, above described, its thieving propensities are not limited to things they can use — in fact, the wider the assortment of material collected, the better they like it. And the things given in barter may be anything from rubbish to articles of value. Generally speaking, they do little harm. Their antics are merely absurd.

As might be expected, the home of this night prowler is fearfully and wonderfully made. On the plains the nests are conical and composed chiefly of sticks; but (according to Edward A. Goldman of the U. S. Biological Survey) thorny vegetation, bits of cactus, bones, stones, leaves, and almost anything else they can carry enter into the construction of their homes. The habit of building nests of sticks and of accumulating

Photograph by the U. S. Biological Survey

BRUSHY-TAILED WOOD RAT

A young specimen of a group that is larger and handsomer than its near kin, and is also marked by a long bushy tail, instead of the usual naked or scaly appendage

houses and nests being built of the usual materials. The Indians on the Stony River, Alberta, called these Rats "medicine rats," in allusion to the musk glands.

This industrious little beast is commonly known in the West as Trade Rat, or Pack Rat, from its well-known habit of carrying things from one place to another, and often leaving other things in exchange, or trade. Many amusing stories are told to illustrate this propensity. On one occasion the Rat removed a quantity of rice from a cupboard jar to an old hat in a storeroom, bringing back in exchange some perfectly good collar buttons. On another, the busy animal, or animals carried a lot of seeds from a drawer and hid them in a vase. This time they did not offer anything in exchange. Their more or less such material about the entrances to their burrows, even when in rocky places, is common to most of the species. Many bushels of trash are often piled against a rock or the trunk of a tree or in a small cave. These nests, or burrows, have from one to half a dozen or more entrances to chambers, both above and below the surface of the ground. More or less well-defined runways usually radiate in several directions from the entrances into the surrounding vegetation or may connect nests many yards apart. Occupied nests may be known at a glance by their well-kept appearance. Slight additions and repairs are made frequently, and the runways are cleared of sticks and leaves. Sure signs of occupation are a few freshly cut twigs or leaves laid on or stuck into the upper walls.

On desert plains a thick clump of cactus or other thorny vegetation is frequently chosen as the nest site, and here pieces of cactus are the chief material used in construction. Often the entire nest is a bristling mass of thorns, and as a further protection some especially spiny sections are placed about the openings and along the smoothly worn runways. When it is remembered that many of the spines have barbed points sharper than needles, which enter the flesh at the slightest touch, it is difficult to understand how the builders transport such material or are themselves able to travel without being pierced.

Wood Rats are expert climbers, and some species, in addition to building surface nests three to five feet in height, often place them twenty feet or more from the ground among the upper branches of trees. None of the species is known to enter water voluntarily, but in Mexico, near the borders of lagoons, at least one of the species occasionally builds nests in the tops of mangroves, from which a single well-worn route always leads through the thick branches out to feeding grounds on the shore, perhaps fifty or seventy-five yards away. Wood Rats do not frequent towns, but often live in the vicinity of farmhouses, and have been known to carry off spoons, knives, forks, pieces of cloth, and many other articles, and add them to their nests.

They are chiefly nocturnal in habits, but some are partly diurnal. Their food is largely determined by varying local conditions, but consists mainly of a great variety of green vegetation, including grass, leaves, fresh fruit, small bulbs, bark, and cactus stems. Dry seeds, nuts and fungi are also eaten. During successive seasons of drought in the Rio Grande valley, when ordinary food is scarce and in consequence most small mammals are greatly reduced in numbers, Wood Rats maintain their usual abundance by recourse to the large, soft, juicy cactuses.

Wood Rats have numerous deadly enemies such as owls, hawks, snakes, wild cats, civet cats, coyotes, foxes and probably weasels, which serve to keep their numbers in check. Some of the desert species are sufficiently numerous to inflict appreciable damage on growing crops in fields and gardens and to carry off considerable grain stored on farms, but they have not thus far proved as injurious as some other rodents. In the arid regions of the Southwest they girdle and kill many native shrubs and severely injure cactuses, especially during the long dry season when food is scarce.

COTTON RAT

Sigmodon hispidus *Say and Ord*

Other Name.— Marsh Rat.

General Description.— A fairly large rodent intermediate in size between the House Mouse and the common Norway Rat. Head rather broad; nose pointed; ears nearly hidden in the long hair; body fairly thickset; tail slender, scaly, thinly haired, shorter than head and body; legs short, slender; pelage long, coarse, hispid; color above, grayish-buff grizzled with black; below, dull white.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical, seasonal variation very slight. Above, pale yellowish-gray, coarsely grizzled with black, paler on sides; lower parts ashy or dull white; ears plumbeous at base; feet grayish-white; tail blackish above, grayish below. Young: Similar to adults but grizzled appearance lacking.

Measurements.— Total length, 10 inches; tail vertebrae, 4 inches; hind foot, 1.3 inches.

Range.— Eastern United States, Carolinas to Florida.

Food.— Seeds, grasses and green vegetation; occasionally flesh.

Remarks.— The Cotton Rats are related to the Rice Rats but because of their coarse hair and bristling coat they are not liable to be confused with any other rodents. Like the Rice Rats, this group is of southern origin and only the northern forms come into the United States. Eight species and subspecies of this rodent are found north of the Rio Grande, but this genus is distributed well down into South America.

Related Species

Cotton Rat.— *Sigmodon hispidus hispidus* Say and Ord. Typical animal as described above. Carolinas to Florida.

Texas Cotton Rat.— *Sigmodon hispidus texianus* (Audubon and Bachman). Smaller than the Common Cotton Rat. Texas and Oklahoma.

Pallid Cotton Rat.— *Sigmodon hispidus berlandieri* (Baird). Small; ears larger; color paler than common Cotton Rat. Eastern desert tract upper Rio Grande, Texas and New Mexico.

Least Cotton Rat.— *Sigmodon minimus* Mearns. Underfur dark; ears, feet and tail densely haired; grayish mixed with blackish and light yellowish-brown. Mountains of southern New Mexico, Arizona and south into Mexico.

The Cotton Rat may be distinguished from the Meadow Mouse, to which it bears a certain resemblance, by its long tail. It is a thickset animal about two-thirds as large as the common House Rat, and what it lacks in size it makes up in courage and destructiveness. According to Hornaday, it is "vicious in temper and voracious in appetite. It is fond of flesh, and when several are caged together, the stronger ones do not scruple to kill and eat weaker rats of their own kind."

either on the surface or in underground burrows. Their runways are very extensive, a perfect network of them often connecting the several burrows. Along these runways they cut the green stems of grass and various plants, eating the stems, leaves, and seeds; and they gather on the edges of grain fields where they feed on both the green and the ripening grain.

They are especially numerous along the borders of cotton fields, and, according to Bailey, the runways opening into the fields are often

Photograph from U. S. Biological Survey

COTTON RAT

The Cotton Rat is a fighter, vicious in temper, and greedy in appetite. It is fond of flesh

Cotton Rats inhabit the Southern States and Mexico, the range of the common species extending from North Carolina to northern Florida and west to southern Louisiana. In the eastern half of Texas a paler and smaller form occurs. Individuals of this species, though common, are not often seen, as they live under cover of tall grass and weeds and along the banks of streams and ditches. They make bulky nests of grass fairly lined with cotton that has been pulled from the bolls and dragged under cover where the seeds can be eaten in safety. "The loss of cotton is not great in any one field, but, considered over the entire range of this group of Cotton Rats, it is considerable." Bailey thinks that a simple and effective means of getting rid of these pests would be "to clean out the borders of fields by burning the weeds, grass, and rub-

bish accumulating along the fences year after year as a harbor for various rodent and insect pests. If these borders were burned yearly, mowed and raked, treated with oil or chemicals to prevent weed growth, closely pastured, or thoroughly cultivated, the hawks and owls would quickly dispose of the rodents, which would then have no protecting cover."

Like the Rabbits and Varying Hares, Cotton Rats have their periods of abundance; and sometimes their increase assumes the proportions of a veritable plague. Mr. H. P. Attwater thus tells of one of these "invasions": "In the year 1889, *Sigmodons* appeared suddenly in this (Bexar) county in great numbers, and were known as 'tramp Rats.' Where they came from, or from which direction, I have been unable to find out. Thousands first appeared about the first of May, and were heard from in all the region for many miles around San Antonio. They made their nests with the Wood Rats in the bunches of *Opuntia*, with a network of runways leading in every direction, through which they were often seen running in the daytime. They seemed to agree with the Wood Rats, but in the oat stacks and around the ranch buildings the common Brown Rats fought, killed, and ate them. Mr. Watson's boys killed over one hundred in one afternoon in a brush fence, and for several months their cat used to bring in from six to twelve every night. He says that on one occasion, when the rats were thickest, they counted thirty-eight which this cat in one night had piled up in the wood box for the amusement of her kittens. The bulk of these Rats stayed for about eighteen months. After the crops were gathered they began to get scarce, and gradually disappeared. Whether they died out or 'tramped' out I am unable to say, but I am inclined to think many of them migrated."

Cotton Rats are very prolific, the females producing eight, and occasionally eleven young at a birth. They have a host of enemies. Hawks sit on the telegraph and fence posts and watch for them, frequently diving into the grass for their prey; barred owls "remove" them nightly, and short-eared owls migrating northward stop over to feast upon them. Weasels, Skunks, dogs, and cats hunt them; and rattlers and other snakes, distributed in their retreats, have been "found gorged with Cotton Rats."

RICE RAT

Oryzomys palustris (*Harlan*)

Other Names.— Rice Field Mouse, Marsh Mouse.

General Description.— A rather large Mouse with a much heavier body than the common House Mouse. Head of moderate proportions; nose pointed; ears of medium size nearly buried in the fur and clothed with short hairs; body slightly thick-set; feet of normal proportions; hind feet large; soles naked; tail scantily haired, about half of total length; general color above, dark brown to pale brown; below grayish; hair rather coarser than that of the House Mouse.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical. Seasonal variation while present not especially noticeable. Above, dark-brown shading into pale-brown, washed with buffy on sides; grayish beneath, the hairs with plumbeous bases and tipped with white, but with grayish underfur showing through; tail above dark, below pale, very scantily haired; feet whitish. Young: Slate gray.

Measurements.— Total length, 8.8 inches; tail vertebrae, 4.4 inches; hind foot, slightly over 1 inch.

Range.— New Jersey to Georgia.

Food.— Seeds, grasses and various plants.

Remarks.— An extensive group which ranges from New Jersey southward over a large part of South America. In the United States only a few species and subspecies, four in number, come under consideration. These four differ only in minor details.

Related Species

Rice Rat.— *Oryzomys palustris palustris* (Harlan). Typical animal as described above. New Jersey to Georgia, westward to eastern Texas.

Texas Rice Rat.— *Oryzomys aquaticus* Allen. Large; feet small; yellowish-brown above. Southeastern Texas.

Florida Rice Rat.— *Oryzomys natator natator* (Chapman). Largest of the United States Rice Rats; coloration darker. Florida west to Texas.

The Rice Rats are quite closely related to the Cotton Rats and to the White-Footed Mice; but from the latter they are easily distinguished by their more robust form and coarsely haired tail as well as larger hind feet; while the Cotton Rats have coarser fur. At first glance one might also have considerable difficulty in distinguishing them from the young Norway Rats; but a closer examination will show that the Rice Rat has a longer tail, is browner in color, and has glossy brown hairs inside its ears, as well as a fringe of white hairs on the lower part of each ear.

The Rice Rats are far more numerous south of the Rio Grande than above it. They have long tails very scantily haired, and to a great extent are inhabitants of the Tropics. In the United States, they must be looked for on the eastern and southeastern coasts, but in Mexico they may be found at altitudes of 10,000 feet or more above sea level.

The typical Rice Rat of North America is found mainly in the coastal marshes of southern New Jersey to the Gulf States, and is most abundant in the banks of rice fields. Some varieties, however, live on sandhills. On Matagorda Island, Texas, Oberholser found them "tolerably common in the tufts of coarse grass bordering bayous, making conspicuous runways where the grass is thickly matted;" and on a small reef off the north end of Padre Island "they were found in patches of marsh 'cranberry.' Two of their round, cup-shaped nests, composed of fine rootlets, were found under old boards." These species are good swimmers and take to water readily.

HOUSE MOUSE

Mus musculus *Linnaeus*

General Description.— The common Mouse found about dwellings. Nose pointed; ears fairly large; body neither thick-set nor slender; tail quite long, longer than head and body; legs fairly long; color above yellowish-brown; hair fairly soft.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— ADULTS: Sexes identical. Seasonal variation slight. Above yellowish or grayish-brown; below, paler, generally ashy-brown, sometimes black hairs along back mixed with yellowish-brown; feet brown; tail dusky, somewhat lighter below; hairs of tail short and scanty. YOUNG: Slaty-gray all over.

Measurements.— Total length, 6.3 inches; tail vertebrae, 3.2 inches; hind foot, .7 inch; ear from notch, .6 inch.

Range.— Practically throughout all North America in districts inhabited by man, and to a certain extent to be found away from settled localities.

Food.— Somewhat omnivorous, but showing preference for grain and vegetable food.

Remarks.— An introduced species, coming from Europe. Only one species has gained a footing in North America.

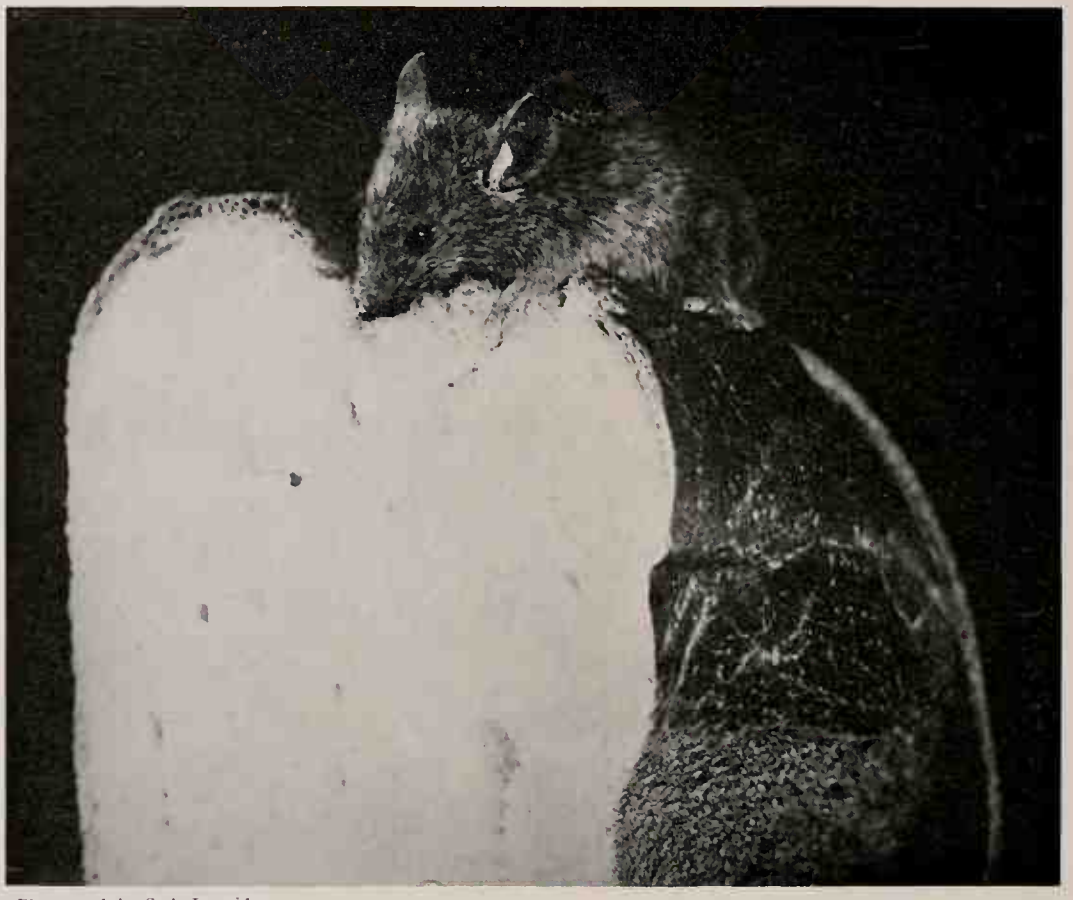
The House Mouse, like the poor, we have always with us. It is the most democratic as well as the most familiar of all our mammals, making its home with equal readiness in the lowly East Side tenement and the palatial Fifth Avenue mansion. No part of a house is sacred to it; no article of furniture, however costly, if suitable in shape and favorably placed, is too good to serve as its nest; no dish of flesh, fish, or fowl, if left within its reach, is either too coarse or too delicate for its palate.

Not every Mouse found in the house, however, is the common House Mouse. Field Mice often gain entry to houses and establish themselves in a very short space of time. The writer once occupied a cottage on Staten Island that was covered with creepers, and the vines overran the wire screens, which in the hall and pantry windows were allowed to remain in position the year through. Often in the dusk, and sometimes in the daytime, we could see the little Field Mice running across the screens. One day some boys, playing baseball in the back yard, sent a hard-batted ball against the pantry screen and broke a hole in it. Not long afterward we found that the pantry was overrun with Mice. The parrot's cage was placed at dark each day in a recess in the pantry, and some Field Mice were seen helping themselves to the birdseed in the cage. They had evidently gained access through the hole in the screen. A circular trap with four springs was attractively baited for the intruders,

and on three successive nights was filled with victims. The fourth night a solitary Mouse, the thirteenth, and unlucky, was found in the trap, and that was the end of our visiting field mice, and of their possible aspirations to be considered House Mice.

On the other hand, House Mice in choosing their dwelling-places do not always confine themselves to houses. Mr. Vernon Bailey, when making a biological survey of Texas, a few years ago, found that they were "by no means confined to houses and outbuildings, but over much of the country had become established in the fields, meadows, hedgerows, and weed patches, from which they collect in the stacks of hay and grain, and are ready to attack each crop as it matures."

The appearance and habits of this little rodent are well known. House Mice are very prolific, and soon become a nuisance, if not checked. They begin to breed when three months old, and have litters at intervals of eight or ten weeks all the year round. There are usually five or ten young at a birth. White Mice in captivity breed oftener and have larger litters. Their nests are made in the oddest and the most unsuspected places. Stone and Cram give the following account of a nest that was made in an old-fashioned sausage-filler: "It was made of tin bottle-shaped and open at both ends, and into the larger one was thrust a piece of wood which just fitted it. The remaining space was occupied by a Mouse's nest of rags and scraps of paper, the funnel-shaped opening serving as an entrance, through which the mother Mouse had probably come and gone hundreds of times in ministering to the needs of her family."



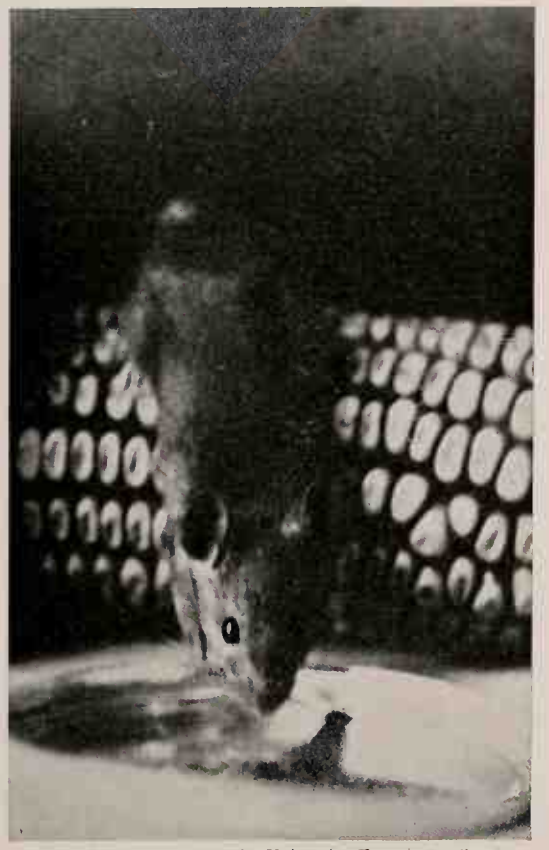
Photograph by S. A. Lottridge

HAVING A FEAST

Flashlight picture of a House Mouse on a loaf of bread

A New York family on returning from the shore about five years ago found that a Mouse had made its nest in a valuable Chinese bowl on

a side table in the parlor. The present writer had an experience which is no less interesting. In his work he used an ordinary pedestal writing table, in the bottom left-hand drawer of which were newspaper clippings. It was a busy editorial office and there were at least forty persons



Photograph by the West Va. University Experiment Station

HOUSE MOUSE

Flashlight picture secured just as this little pest was having a drink

in the room, many of whom were continually passing the table. One day on opening the drawer a Mouse sprang out, leaving behind it a litter of ten young in a cozy little nest made entirely of pieces of newspaper which had been torn into mere shreds. The eyes of the little Mice were closed and the animals themselves were hairless.

It seems to be well established that the House Mouse is to a certain extent musical; at any rate, that it has a kind of song. Mr. Ernest Ingersoll cites from the *Scientific American* the following: "A few winters since, while one of the family was amusing herself at the piano, a Mouse made its appearance on the threshold of the apartment, and, undismayed by the light or the presence of the family, chirped and caroled with intense satisfaction to itself and to the great delight of its audience. Frequently afterward, but always in the evening, the rare songster repeated his performance. The piano keys were never struck that the Mouse did not follow; but when the instrument was not touched, the music from the Mouse would come, as if for a reminder." Dr. Coues attributed these "singing" exhibitions to an affection of the throat, but they are now supposed generally to be quite natural.

Another "accomplishment" is the dancing or waltzing of the small black and white Japanese Mice. Mr. S. C. Lloyd (in *Country Life in America*) advocates breeding these Mice as a source of income. They sell for $1 to $1.75 each. "As soon as they have their eyes open," he says, "they commence to spin round, and they keep this up through life." Mr. Lloyd has trained his White Mice to "pull little circus wagons with a tiny Mouse inside; to shoot the chutes; to climb ladders and perform on the trapeze; to walk tight ropes, and to tell fortunes. The trouble involved in teaching is very small when compared with the profits, the only equipment expense being that of a suitable cage which lasts a life-time."

ALBERT PORTER.

GRASSHOPPER MOUSE

Onychomys leucogaster (*Wied*)

Other Names.— Scorpion Mouse, Mole Mouse.

General Description.— A thick-set, short-tailed Mouse, noticeably larger and heavier than the House Mouse. Head large; ears of moderate height covered with very short hair; body rather thick-set; tail short, thick, blunt, covered with short hairs and about half length of head and body; legs of moderate length; fore feet large with long claws; general color grayish-

brown above, yellowish-red on sides, and below clear white; hair on body long, lax and remarkably soft. Nocturnal in habit.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— ADULTS: Sexes identical. A seasonal variation, but not very conspicuous. Above, grayish-brown, darker along dorsal region, becoming yellowish-red on sides, and graduating into a line of fulvous; underparts, feet and outside of fore legs white; tail blackish-brown above, underside and terminal eighth, white. YOUNG: Mouse gray above, below white.

Measurements.— Total length, 6 inches; tail vertebrae, 1.7 inches; hind foot, .9 inch.

Range.— Dakota, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory and Texas.

Food.— Largely insects, grasshoppers, scorpions, crickets, beetles and occasionally other Mice, as well as some seeds and vegetation.

RELATED SPECIES

Grasshopper Mouse, or Scorpion Mouse.— *Onychomys leucogaster leucogaster* (Wied). Typical animal as described above. Plains of Dakota, Missouri, Nebraska, Kansas, Oklahoma and Texas.

Gray Scorpion Mouse.— *Onychomys leucogaster fuscogriseus* Anthony. Similar to *leucogaster*, but coloration richer and colors more contrasting. Oregon and Washington.

California Scorpion Mouse.— *Onychomys ramona* Rhoads. Smaller than the above species, coloration brighter, more red. Southwestern California.

Long-tailed Grasshopper Mouse.— *Onychomys longicaudus* Merriam. Above, cinnamon fawn with black-tipped hairs; tail about 2.15 inches. Utah.

Yuma Grasshopper Mouse.— *Onychomys torridus perpallidus* Mearns. Size large; coloration very pale. Arizona and California in southern desert region.

Dusky Grasshopper Mouse.— *Onychomys fuliginosus* Merriam. Size rather large; ears large; pelage somewhat coarser than in the other species; blackish-slate above. Northeastern Arizona.

The Grasshopper, or Scorpion, Mice are a well characterized group related to the White-footed or Deer Mice, but are easily distinguished from the other Mice by their coloration, when taken in connection with their short thick tail and heavy body. They are probably the least dependent upon a vegetarian diet of any of our Mice and are also adapted for burrowing as is shown by the long claws on the fore feet. There are some fifteen species and subspecies ranging in the United States. These forms are strictly plain or desert types.

Grasshopper Mice are nocturnal. They especially frequent sandy areas, and are often taken in traps set at the burrows of Kangaroo Rats, Ground Squirrels, and Pocket Mice. Their carnivorous propensity is one of the chief obstacles the collector meets in trapping the rarer desert Mice, and often after nights of trapping without success he is chagrined to find in one of his traps the partly devoured and mangled remains of a rare Pocket Mouse. Sometimes in regions where Grasshopper Mice are plentiful, a miscellaneous catch of other species will be almost ruined by them. Much of the food of Grasshopper Mice consists of soft-bodied insects, such as grasshoppers and crickets. The name Scorpion Mice, sometimes applied to these rodents, is due to a marked fondness for scorpions, which probably form part of their food in Colorado, particularly in the Southwest. Vegetable food is also eaten.

In some one of its varied forms, the Grasshopper Mouse is found from the Dakotas south to Texas. They vary considerably as regards their haunts. The pale form prefers a sandy soil with a good growth of sagebrush. Mr. Vernon Bailey ("Biological Survey of Texas,") says: "They make few holes, though two were taken at the mouths of small burrows. They are strictly nocturnal, and, while never seen by daylight, their long-drawn fine whistle is often heard in the grass between dusk and early dawn. The morning round of a line of traps usually reveals one or more specimens that have been attracted by the oatmeal bait." Another Texan form, large and dull-colored, inhabits grassy, brushy land in the half-open cactus and mesquite country, and is found in the woods as well as in the open. It also is strictly nocturnal, and its shrill whistle has been heard not far from camp fires. The Dusky Mouse of the Painted Desert and the high mesas, northeastern Arizona, is a remarkable example of color adaptation to environment, its slate-black hue according perfectly with the black lava beds in which it has its home.

HARVEST MOUSE

Reithrodontomys humulis (*Audubon and Bachman*)

General Description.— A very small Mouse scarcely more than one-half the weight of the House Mouse. Head small; nose pointed; ears rather large, thinly haired; body slender; tail long and scantily coated with hair; feet of moderate length, slender; front incisors with conspicuous longitudinal, median groove; general color above, fuscus brown; underparts dingy gray; hair of moderate coarseness.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical. Seasonal variation occurring but not especially conspicuous. Above, fuscus-brown, darker along median dorsal line; sides more fulvous, with indistinct lateral line; underparts dingy-gray tinged with fulvous; feet whitish; ears dusky; tail above dusky, below grayish-white. Young: Similar to adults but grayer.

Measurements.— Total length, 5 inches; tail vertebrae, 2.2 inches; hind foot, .7 inch; ear, .4 inch.

Range.— Coast district of South Carolina and Georgia, southward into Florida.

Food.— Seeds and grain.

Related Species

Harvest Mouse.— *Reithrodontomys humulis humulis* (Audubon and Bachman). Typical animal as described above. South Carolina, Georgia, southward into Florida.

Merriam's Harvest Mouse.— *Reithrodontomys merriami* Allen. Smaller and darker. Coast district of southwestern Louisiana into Texas.

Kansas Harvest Mouse.— *Reithrodontomys dychei dychei* Allen. A small, dark form with spots at base of ears. Kansas east to St. Louis, Missouri, south to Oklahoma, north to Nebraska and southwestern Iowa.

Mountain Harvest Mouse.— *Reithrodontomys montanus* (Baird). Coloration above brown, below yellowish-gray. Colorado.

Large-eared Harvest Mouse.— *Reithrodontomys megalotis megalotis* (Baird). Largest of the Harvest Mice, ears large, total length nearly 6 inches. Western New Mexico, eastern Arizona, Utah, California and southern Nevada.

Long-tailed Harvest Mouse.— *Reithrodontomys longicauda longicauda* (Baird). Size small, colors dark; tail long, more than half the length of head and body. Western California.

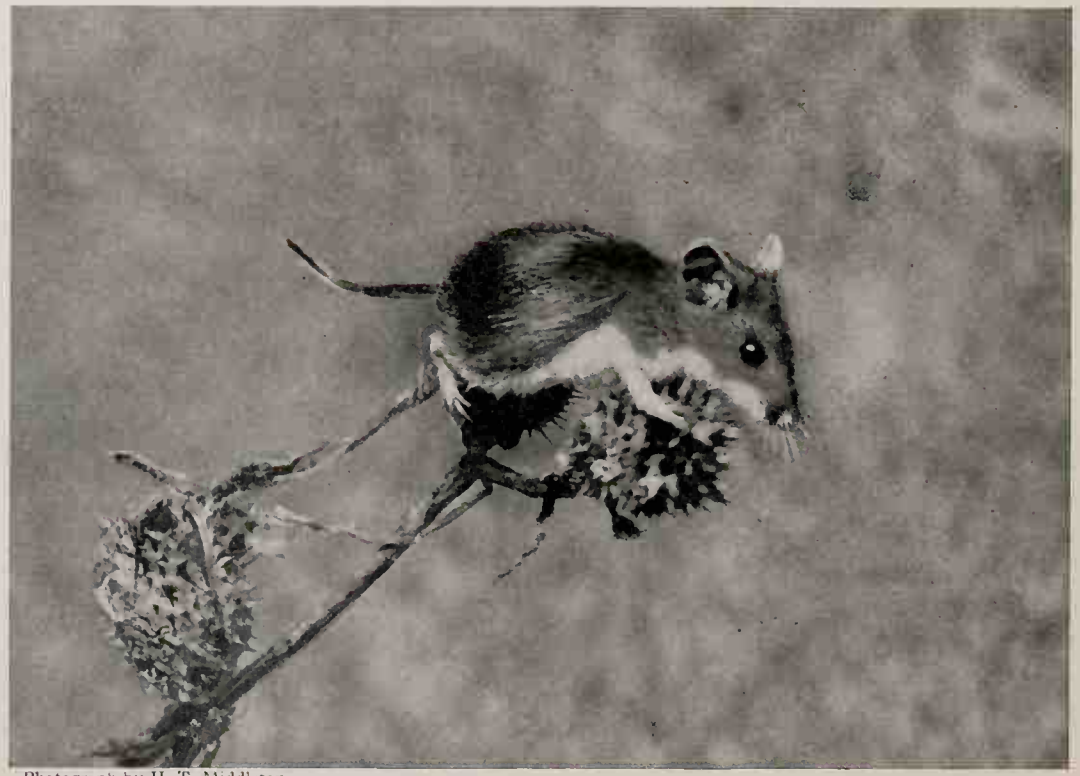
Drawing by Henry Thurston

HARVEST MOUSE

One of the smallest of our native Mice, weighing about half as much as the House Mouse. A creature of the open, grassy country

The Harvest Mice are, with the exception of the Pocket Mice, the smallest of North American rodents. They are more delicately constructed than any of the other Mice, and both by this character and the groove on the incisors they may be distinguished from the White-footed or Deer Mice, which they most closely resemble, and to which their relationships connect them. This group has been classified into a great number of species and subspecies. In all fifty-nine are known north of Panama, of which about twenty-two have ranges in the United States. The group inhabits temperate to tropical areas and is not found north of the United States. In western North America specimens have been taken as far north as Washington, Montana, and North Dakota, but east of the Mississippi River the animal has not been found north of the Ohio and Potomac valleys.

Harvest Mice are partial to open grassy localities. Some species like moist places; others live in sandy, dry uplands; still others inhabit marshes exclusively; while some of the Mexican species ascend mountains to the timber line. Their nests are substantial constructions, lined with soft materials and built in widely varying positions. Vines, low trees, woodpeckers' holes, fences, deserted birds' nests, cornstalks (the nests in these cases being made of corn silk), cracks in the ground — such are some of the places in which nests of the Harvest Mouse have been found. Bailey thus relates his discovery of a nest of the Rio Grande Harvest Mouse with a very sleepy tenant, near Corpus Christi, Texas: "I found what looked like an old verdin's nest in a bush of *Momesia pallida* near Corpus Christi. The nest was about four feet from the ground, a globular structure of grass, lichen, and short gray moss, with a small opening at one side. As I touched the side, two black eyes appeared at the doorway, but after watching me for a moment were withdrawn. At a slight shake of the bush, out popped a trim little long-tailed Harvest Mouse, which sat undecided on



Photograph by H. T. Middleton

WHITE-FOOTED MOUSE

The alert photographer caught this little beast in the open, as he scampered up a thistle

Photograph by H. T. Middleton

EASTERN WHITE-FOOTED MICE

Also called Wood Mice because they are often found in forests of evergreen or deciduous trees. Photograph nearly life size

the branch for a moment and then ran gracefully along branches and stems from one bush to another and finally down to the ground, where

Photograph by S. A. Lottridge

NEST OF A HARVEST MOUSE

it disappeared in the tall grass. On examining the nest I found a firm base, evidently an old bird's nest that had been arched over with a substantial roof which left an opening at the side only large enough for my finger. It was neither a verdin's nor a cactus wren's nest, and had evidently been built by the present tenant. When I returned next day, the Mouse was at home, but so sleepy that I merely disturbed him enough to make him come out and sit a moment on the branch, after which I withdrew and let him go back to finish his nap."

The food of the Harvest Mouse consists principally of seeds, grain, green vegetation, and, occasionally, fruit. Most of their food must be obtained from wild plants of little or no value to man. In Bexar County, Texas, they were found to be fond of peaches, eating the peach and leaving the stone hanging on the tree; and at Metlaltoyuca, Mexico, one was caught on a bunch of bananas hanging about eight feet above the ground. Mr. Arthur H. Howell, of the United States Biological Survey, says that only rarely is any damage to crops by Harvest Mice reported; and Bachman, who had studied its habits closely, remarks: "We doubt whether this species is of much injury to the farmer. It consumes but little grain, is more fond of residing near grass fields, on the seeds of which it subsists, than among the wheat fields."

The breeding season extends from April to October in northern latitudes; in tropical regions it is probably spread over the whole year. The young produced at a birth number from three to seven and rapidly attain their maturity. But owls and other enemies keep their numbers down.

EASTERN WHITE-FOOTED MOUSE

Peromyscus maniculatus (*Wagner*)

Other Names.— Deer Mouse, Wood Mouse.

General Description.— A medium-sized Mouse of normal proportions, slightly larger than the common House Mouse. Nose pointed; head of moderate proportions; ears large, prominent, covered with very short hair; eyes large; whiskers prominent; body medium; tail long, about length of head and body, and well clothed with short hair; limbs slender and of moderate length; general color above, yellowish-brown; below, clear white; hair of moderate length and quite soft.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$

Pelage.—Adults: Sexes identical. Seasonal variation occurring but not especially conspicuous. Above varying from bister to yellowish-brown; below clear white, the white meeting the color of the sides in a clearly defined lateral line; feet white; tail above like back, below white, sharply bicolor. Young: Slate gray.

Measurements.— Total length, 6.5 inches; tail vertebrae, 3 inches; hind foot, .8 inch.

Range.— Northeastern Canada from Labrador to Hudson Bay, and south to northeastern United States.

Food.— A great variety of seeds, grain, nuts, acorns, leaves and grasses.

Related Species

Eastern Deer Mouse.— *Peromyscus maniculatus maniculatus* (Wagner). Typical animal as described above. Northeastern United States and west to Hudson Bay.

Arctic White-footed Mouse.— *Peromyscus maniculatus borealis* Mearns. Much shorter tail than Eastern Deer Mouse. Interior of northwest Canada.

Canada White-footed Mouse.— *Peromyscus maniculatus gracilis* (LeConte). Larger, with longer, more hairy tail and less rusty coloration. New Brunswick south to central New York and western Massachusetts.

California Deer Mouse.— *Peromyscus californicus* (Gambel). Largest of the Deer Mice north of the Rio Grande. Similar to Eastern in general proportions but body much larger (4 inches); ears very large;

tail very long, more than half the total length, very sparsely haired, the annulations of the tail plainly visible; hair very long, lax and soft. General color, dark gray mixed with light brown; below grayish buff. Coast region of California from San Francisco Bay south to Santa Barbara in open forest, in brush and in valleys of lower mountains.

Large-eared Deer Mouse.—*Peromyscus truei truei* (Shufeldt). Size medium; tail a little less than head and body in length; ears very large. Southwestern United States.

Desert Deer Mouse.—*Peromyscus eremicus eremicus* (Baird). Size medium; tail very long, longer than head and body; colors pale. Desert regions of southeastern California eastward to western Texas.

Golden-breasted Deer Mouse.—*Peromyscus crinitus auripectus* (Allen). Size medium; hairs long and silky; coloration bright above; yellow spot on breast; rest of underparts white. Northeastern Arizona, southeastern Utah and adjacent parts of Colorado and New Mexico.

Nuttall's Deer Mouse.—*Peromyscus nuttalli nuttalli* (Harlan). Tail less than head and body in length; coloration bright orange. Southeastern Virginia and northern North Carolina west to central Kentucky.

Taylor's Deer Mouse, or Little Deer Mouse.—*Baiomys taylori taylori* (Thomas). One of the smallest of North American Mice; coloration yellowish-brown thickly lined with black; tail indistinctly bicolor; total length, 3.5 inches; tail vertebrae, 1.4 inches. Southern Texas.

From West Va. University Experiment Station

WHITE-FOOTED MOUSE

An interesting and accurate life photograph, showing a characteristic pose of this small rodent, which is feeding on a nut

The White-footed Mouse is by far the most beautiful species of the family to which it belongs. Indeed it is almost a shame to call this handsome creature a mouse at all! He is almost a dandy in dress and neatness, and his spotless robe of grayish fawn above is sharply contrasted with the pure white beneath. This, coupled with the natural grace and agility of his movements, distinguishes the White-footed Mouse as one of our most attractive little mammals.

Combined with this grace and beauty there is a gentleness of disposition reminding one of the Flying Squirrel. It is said that these two little wood-dwellers are sometimes found living in the same cavity. An adult White-footed Mouse, when captured wild, will seldom bite if taken in the hand, and after two or three days of confinement is as gentle and confiding as though it had been born in captivity.

The home of the White-footed Mouse is occasionally found in deep forests of evergreens or deciduous trees; but its usual abode is along hedgerows, in the fields, or even in dwellings about well-wooded sections of the country. The hunter's camp is very sure to be visited by them,

and sometimes their friendliness becomes a burden. While their usual food is nuts and seeds of various kinds, they soon learn to eat almost anything about the camp. These little fellows show a most surprising capacity for food, and when once a hungry horde of them takes possession of the camp, well may the hunters and trappers look carefully after their stock of provisions; for when the snow lies deep through the forest and the nearest store is forty miles away, then every ounce of flour and meal is precious.

This little rodent has sharp teeth which he sometimes uses in a careless and inconsiderate manner, as cord, fish-line, hunting-tackle and even snares set for other animals are cut to pieces. The trap is often sprung and the bait which might have caught a Mink or Marten has been devoured by this small midnight marauder.

Under favorable circumstances the White-footed Mouse stores up considerable quantities of beechnuts for winter use. These seem to be his favorite nuts. Occasionally, when nuts are not obtainable, seeds and grains of various kinds are stored. The nuts are usually shucked when gathered — at least this has been the present writer's observation — and placed in a hollow of a tree or log. Woodsmen often find stores of nuts. Several years ago I found a storehouse of some White-footed Mice in a cavity of a maple tree. There were nearly three and a half quarts of as beautifully shucked nuts as anyone would wish to see. Only last year I found in a stump another storehouse, containing a quart of beechnuts and an equal amount of buckwheat.

The White-footed Mouse, like some of the Squirrels, constructs an outside nest in thick tangles of bushes from four to ten feet above the ground. The favorite location seems to be about some gently inclined vine, such as the wild grape, which affords a natural and easy highway from the ground to the home of the wee architect. The nests are slightly globular in shape, and composed of dried leaves, grasses, moss and fibrous barks of various kinds, the material being closely compacted and the general appearance very pleasing. The entrance is usually on the lower side. Sometimes the foundation is an old bird's nest, very often that of a cat-bird. I once found a nest that was fifteen inches in length and about eight inches in diameter, this being the most irregular in shape as well as the largest one that I ever saw.

Occasionally several Mice will occupy the same nest, and if disturbed they hasten out, making their way along the branches to the ground. If the disturbance is slight, they come out upon the branches, gaze about on all sides and gently sniff the air, not returning until they are satisfied that all danger has passed.

"Singing Mice" are reported from time to time, and even among the White-footed variety they are no exception, according to a note that appeared in the *American Naturalist* several years ago by Mr. Hiskey, who wrote as follows:

"I was sitting a few evenings since not far from a half-open closet door, when I was startled by a sound issuing from the closet, of such marvelous beauty that I at once asked my wife how 'Bobbie Burns' (our canary) had found his way into the closet, and what could start him to singing such a queer and sweet song in the dark. I procured a light and found it to be a Mouse! He had filled an overshoe from a basket of popcorn which had been popped and placed in the closet in the morning. Whether this rare collection of food inspired him with song I know not, but I had not the heart to disturb his corn, hoping to hear from him again. Last night his song was renewed. I approached him with a subdued light and with great caution, and had the pleasure of seeing him sitting among his corn and singing his beautiful solo. I observed him without interruption for ten minutes, not over four feet from him. His song was not a chirp, but a continuous song of a musical tone, a kind of to-wit-to-wee-woo-woo-wee-woo, quite varied in pitch."

The White-footed Mouse reproduces very rapidly, as there are from two to four litters in a year and from three to six young in a litter. This Mouse has many enemies, such as the Fox, Wild Cat, various kinds of owls, house cat, and, the most formidable of all, the common Weasel.

Once while passing through a thicket, an unfamiliar sound caused the present writer to stop and listen. Peering through the brush I discovered a screech owl standing on the side of an old bird's nest, only a short distance away. It was after sundown, but the light was sufficient to enable me to see objects quite distinctly some distance away. The owl was absorbed in tearing apart what, at first sight, I supposed to be the bird's nest. So intently was he engaged in this task that I approached unobserved, and when within thirty feet of the bird I discovered that a White-footed Mouse had placed his home on the top of the bird's nest. The owl evidently knew that it was the abode of the Mouse, for he was opening the nest by using both his beak and claws. Suddenly a White-footed Mouse sprang from the nest, which was not more than

four feet from the ground, and struck upon the dried leaves below. Instantly the owl dropped upon him and bore him away in his talons.

The White-footed Mouse is a very interesting pet. In captivity it resembles in many ways the Flying Squirrel, especially in its fondness for climbing about one's person and hiding in the pockets. During the day it usually remains in its nest, but at twilight it becomes very active and playful. There are many different species of this graceful little rodent; that is to say, it has adapted itself to its surroundings so completely — wherever it may choose to make its home — as to become differentiated in a great variety of characters. There are recognized north of the Rio Grande some sixty-eight species and subspecies of Mice belonging to this group. As might be expected, a considerable range of variation is shown by the extreme members of this very large series. In color they vary from almost black to a very pale gray; and in size from quite small to almost the size of a small house Rat. Considerable variation in structure, such as the length of tail and height of ear is also shown.

This group is extremely wide in its range and it may be safely said to occur wherever conditions are favorable to support higher life. It is found in timbered regions and on the plains, in areas of heavy snowfall or excessive rain and in the drier deserts. But wherever found it is the same general type, its habits only differing somewhat according to its choice of home.

S. A. Lottridge.

Photograph by West Va. University Experiment Station

WHITE-FOOTED MOUSE

Picture taken as it was scampering down the branches of a pine

LEMMING MOUSE

Synaptomys cooperi *Baird*

General Description.— Rather smaller than the True Lemming and superficially very much like the Meadow Mouse. Upper incisor with distinct groove near outer edge; head blunt; ears nearly hidden in fur; body moderately robust; tail very short; legs short; feet of normal proportions; general color reddish-brown above, plumbeous gray below. Pelage a trifle coarse.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}$=16.

Pelage.— ADULTS: Sexes identical. *Summer.* General color of upper parts grizzled gray and yellowish-brown, lined with black; underparts, whitish; tail above, brown, below, whitish. *Winter.* Grayer and less reddish-brown. YOUNG: Slate or grayish-brown according to age.

Measurements.— Total length, 5 inches; tail vertebrae, .75 inch; hind foot, .8 inch.

Range.— Eastern Massachusetts to Minnesota, south to North Carolina, Tennessee, Indiana and Iowa.

Food.— Stems of grasses, green vegetation, roots.

Cooper's Lemming Mouse.— *Synaptomys cooperi* Baird. Typical animal of the above description. Eastern United States, Massachusetts to Minnesota, south to North Carolina, Tennessee, Indiana and Iowa.

RELATED SPECIES

Quebec Lemming Mouse.— *Synaptomys fatuus* Bangs. Smaller than Cooper's Lemming Mouse. New Brunswick, Quebec, Ontario.

Labrador Lemming Mouse.— *Synaptomys innuitus innuitus* (True). Grayish-brown above; beneath, gray; about size of Cooper's Lemming Mouse. Common to Labrador.

Dall's Lemming Mouse.— *Synaptomys dalli* Merriam. Size large; coloration above, raw umber mixed with black; beneath grayish-white. Valley of the Yukon, western Alaska.

The Lemming Mice are in appearance intermediate between the True Lemmings and the Meadow Mice. The characters outlined above are ample to separate this Mouse from either of these two groups. Some of the Lemming Mice range up into Arctic America, but most of the species are found in more temperate regions. Thirteen species and subspecies are known.

Lemming Mice may be distinguished from Meadow Mice by their very short tail and grooved front teeth; but the general appearance of the two animals is so similar that one is often mistaken for the other. Little is known of their habits. Generally speaking, the Lemming Mice are to be found in wet bogs, on the borders of lakes, or about muskeg ponds, although in Indiana they sometimes frequent stony pastures on hillsides. Cooper's Lemming Mouse is found from Massachusetts to Minnesota and south to North Carolina. It is fond of using the runways of Meadow Mice and as a consequence is often caught in them.

LONG-TAILED LEMMING MOUSE

Phenacomys longicaudus *True*

General Description.— Superficially very much like a long-tailed Meadow Mouse. Head fairly blunt; ears small and not very prominent; body of normal proportions; tail long, almost half total length; limbs of normal proportions; feet slender; general color, bright rusty brown mixed with black; below, white tinged with brown; pelage of moderate length.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}$=16.

Pelage.— ADULTS: Sexes identical. Seasonal variation slight. Above, bright rusty brown mixed with black; underparts, white tinged with rusty brown; hairs on throat white to the roots, hairs of the rest of underparts plumbeous at base; tail uniform chocolate brown; feet brown. YOUNG: Dark gray.

Measurements.— Total length, 6 inches; tail vertebrae, 2.4 inches; hind feet, .8 inch; ears, .2 inch.

Range.— Coast district of Oregon.

Food.— Vegetation and probably a few insects.

RELATED SPECIES

Long-tailed Lemming Mouse.— *Phenacomys longicaudus* True. Typical animal as described above. Coastal Oregon.

Mountain Lemming Mouse.— *Phenacomys orophilus* Merriam. Tail short; above grayish-brown tinged with yellow, thickly sprinkled with black. Mountains of British Columbia and western United States south to Mt. Shasta.

Labrador False Vole.— *Phenacomys ungava ungava* Merriam. Smaller than the Long-tailed Lemming Mouse; face more yellow than rest of body; color pale yellowish cinnamon brown. Labrador.

The Long-tailed Lemming Mouse belongs to a group very closely related to the Common Meadow Mouse. For a long time naturalists classified them together and this fact gave rise to the name *Phenacomys*, which means False Mouse. The characters which separate the two are not superficial and can only be determined by careful examination. The best difference is the fact that the molar teeth of *Phenacomys* have two roots while those of the Meadow Mouse are quite rootless. The Long-tailed Lemming Mouse, however, may be recognized from the fact that it is a tree-loving rodent and lives in the Douglas fir. But the other species are not arboreal and consequently are very easily confused with the Meadow Mice. Eleven species and subspecies of this group of Lemming Mice are known.

TRUE LEMMING

Lemmus trimucronatus (*Richardson*)

General Description.— A heavy-bodied, very short-tailed Mouse of the Arctic regions. Nose blunt and hairy; form stout, compact; ears small, hidden in the fur; tail short, stout, densely haired, tipped with long hairs; legs short; fore feet large with long fossorial claws, thumb rudimentary with long flat claw; hind feet short, broad, with hairy soles and naked tubercles; fur of medium length and somewhat coarse; general color yellowish-brown.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical. Seasonal variation occurring but not especially different in winter. Head and fore part of back, mixed clove brown and yellowish-brown; below, bluish-gray mixed with yellowish-brown hairs; tail gray. Young: Similar to adults but grayer.

Measurements.— Total length, 5 inches; tail vertebrae, .7 inch; hind foot, .9 inch.

Range.— Arctic regions of North America.

Food.— Green vegetation and roots.

Related Species

True Lemming.— *Lemmus trimucronatus* (Richardson). Typical animal as described above. Arctic America.

Yellow Lemming.— *Lemmus helvolus* (Richardson). Size large; coloration brownish-yellow or rust color, mixed with black. Arctic America.

Black-footed Lemming.— *Lemmus nigripes* (True). Fore feet black above; upper parts uniform cinnamon-gray. Pribilof Islands, Alaska.

The Lemmings are a well differentiated group of thick-bodied Mice quite closely related to the common Meadow Mice of the temperate regions. From the Meadow Mice they may easily be told by their rather heavier bodies, very short tail and large fore feet. None of the True Lemmings comes south of the Arctic regions. There are but six species and subspecies. They do not change color in the winter, as do the False Lemmings.

The True Lemming is an inhabitant of the Hudson Bay region. It burrows extensively, and its holes seem to be connected in an endless labyrinth, mainly under the boulders between the shore and some shallow lagoons. The number of young is from four to six.

Another variety discovered by Richardson is somewhat larger and more yellowish in color. It has been described as a rusty black. Still another, the Black-footed Lemming, is marked as its name indicates by black on its fore feet. This rodent lives in the Pribilof Islands, off the coast of Alaska. They probably reached here originally partly by swimming or on floating ice, and this may have been the result of a migration for which some Arctic Lemmings are famous. A general movement of this nature is widespread and is probably caused by overcrowding and consequent scarcity of food. Dr. Coues says of such a migration: "Nothing can stop them; they proceed straight on in their course, urged by some restless impulse, swimming broad rivers and lakes and invading towns which may lie in their way."

Photograph by H. T. Middleton

DEER MICE

Climbing a telegraph pole

FALSE LEMMING

Dicrostonyx hudsonius (*Pallas*)

Other Names.— White Lemming, Snow Lemming, Pied Lemming, Hudson Bay Lemming.

General Description.— Similar in appearance to the True Lemming but with smaller head and less robust body. Nose blunt; ears almost covered in the fur; body moderately thick-set; tail and legs very short; four claws on front feet; two middle claws on fore feet becoming excessively enlarged in winter; general color ashy gray mixed with reddish and blackish; lower parts reddish; in winter everywhere pure white; hairs fairly long and soft.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical. *Summer.* Above, ash gray mixed with reddish and blackish-brown; lower parts reddish; a dark brown lateral line from sides of face and neck dividing the colors of upper and lower parts; grayish-black streak from nose to nape; sides of head gray; whiskers brown or white. *Winter.* Pure white everywhere. Young: Slate color.

Measurements.— Total length, 5.5 inches; tail vertebrae, .6 inch; hind feet and claw, .8 inch; fore feet and claw, 1.2 inch, longest claw, .4 inch.

Range.— Arctic America from Labrador west.

Food.— Green vegetation, grass stems and roots.

Related Species

False Lemming, or White Lemming.— *Dicrostonyx hudsonius hudsonius* (Pallas). Typical animal as described above. Eastern Arctic America.

Richardson's White Lemming.— *Dicrostonyx richardsoni* Merriam. Size large; third nail of fore foot larger than fourth. Hudson Bay region about Fort Churchill.

Alaska White Lemming— *Dicrostonyx nelsoni* Merriam. Size rather small; upper parts chestnut; feet white; winter pelage pure white. Arctic Alaska from Point Barrow.

The False Lemmings, while markedly resembling the True Lemmings, may be readily distinguished from them by reason of the enlarged claw on the front foot, and in winter by the white coloration. All of the False Lemmings turn white in winter and none of the True Lemmings do so. Six species of White Lemmings have been described, all to be found in some part of Arctic America.

The Hudson Bay Lemming has very small ears, hidden in the fur, and a tail so short that it can scarcely be seen. The pelage, which in

Photograph by the West Va. University Experiment Station

MEADOW MOUSE

The Meadow Mice are probably the most abundant small rodents in North America

summer is brown or brownish gray with a black stripe down the back, becomes almost snow-white in winter.

The variety known as Nelson's Lemming occurs in Alaska. E. W. Nelson was able to take some of these Lemmings alive. He states that they were amusing, inoffensive little creatures and from the first allowed themselves to be handled without attempting to bite. "They would climb up into my hand and from it to my shoulder without a sign of haste or fear, but with odd curiosity, keep their noses continually sniffing and peered at everything with bright bead-like eyes. When eating they held their food in their fore paws."

Lemmings have the appearance of small Rats. They feed mainly on mosses, stalks and roots of grasses, and the tender shoots of birch, and in searching for food make long galleries under the snow. They make nests, usually of hair and rye grass; they have two broods a year; and produce four to six young at a birth. It is often stated that American Lemmings do not migrate as those of the Old World do; but Rae observed some as migrating northward near the mouth of the Coppermine River early in June, 1851. An account of this migration is given by him in the *Journal of the Linnaean Society* as follows: "I am not aware if it is generally known that the Lemmings of North America migrate much in the same manner as do those of Norway and Sweden. When traveling in June, 1851, southward from the Arctic Coast along the west bank of Coppermine River, and north of the Arctic Circle, we met thousands of these Lemmings speeding northward, and as the ice on some of the smaller streams had broken up, it was amusing to see these little creatures running backward and forward along the banks looking for a smooth place with slow current at which to swim across. Having found this, they at once jumped in, swam very fast, and on reaching the opposite side gave themselves a good shake, as a dog would, and continued their journey as if nothing had happened."

One species of the Hudson Bay Lemming is found in abundance around Fort Churchill and on the Barren Grounds. These Lemmings frequent the gravelly ridges, the remains of old sea-beaches, bordering the bay. Mr. Edward A. Preble who, with his brother, captured about 120 specimens in 1900, states that they make burrows but no runways. The only food found in the burrows was a few leaves of the bearberry. Each burrow seemed to be tenanted by only a single individual, except in the case of a mother Lemming and young. The breeding season seemed to be nearly over in August, and every litter found consisted of three. The young "were very readily tamed and took rolled oats and crumbs of bread within a few hours of their capture. They sat on their haunches and held their food in their fore feet like Squirrels. The old ones fought viciously when captured, and their sharp incisors and strong jaws made them somewhat formidable."

COMMON MEADOW MOUSE

Microtus pennsylvanicus (*Ord*)

Other Names.— Eastern Vole, Field Vole, Field Mouse.

General Description.—A medium-sized Mouse, short-tailed, with body rather heavier than that of the common House Mouse. Head large and blunt; ears low and almost hidden in the fur; body thick-set; tail short, about twice as long as hind foot; fur long, overlaid with coarse hairs; legs short; soles of feet naked and having six plantar tubercles; molar teeth with a great number of sharp angles in the enamel, thus furnishing many sharp cutting edges; mammae eight; general color dusky gray or brownish.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical. *Summer.* Upper parts, dull chestnut-brown varying to bright yellowish-chestnut, darkened along back with coarse black hairs; under parts, dusky gray or tinged with cinnamon; feet brownish; tail dusky above, slightly paler below. *Winter.* Colors duller and uniformly grayer throughout; tail indistinctly bicolor. Young: Uniform dark slate-gray.

Measurements.— Total length, 6.7 inches; tail vertebrae, nearly 2 inches; hind foot, .8 inch.

Range.— Eastern United States and westward to Dakota and Nebraska.

Food.— Omnivorous to a considerable degree, but principal articles of diet, grass, grain and green vegetation.

Remarks.— Meadow Mice are found in so many habitats, and are so susceptible to environmental conditions, that they have become differentiated in many different details such as color, size, character of pelage, length of tail, number of little pads on the feet, etc. There are at least 76 species and subspecies in this country. Only a few may be listed here.

RELATED SPECIES

Common Meadow Mouse, or Eastern Vole.—*Microtus pennsylvanicus pennsylvanicus* (Ord). Typical animal as described above. Eastern United States westward to Dakota and Nebraska.

Drummond Vole.—*Microtus drummondii* (Andubon and Bachman). Much smaller, slenderer and paler than the Eastern Vole. From Hudson Bay to west slope of the Rocky Mountains and Alaska, and from northern edge of United States north to Fort Anderson, Mackenzie.

Mountain Vole.—*Microtus montanus montanus* (Peale). Size moderate; tail longer than that of Eastern Vole; color yellowish-brown mixed with black. Northeastern California, eastern Oregon, northern Utah and Nevada.

Dwarf Vole.—*Microtus nanus nanus* (Merriam). Size small; ears small; color, pale grizzled brown mixed with black.

California Vole.—*Microtus californicus californicus* (Peale). Tail twice as long as hind foot; color, pale yellowish-brown mixed with black. California west of Colorado desert, and the Sierra Nevada from San Diego county, California, to Rogue River, Oregon.

Townsend Vole.—*Microtus townsendii* (Bachman). Size very large; tail long; colors dark. Low country west of Cascades from Port Moody, British Columbia, south to Willamette Valley, Oregon.

Yellow-cheeked Vole.—*Microtus xanthognathus* (Leach). Size large; ears large; tail shorter than head; above dark brown and black; blackish-brown stripe on nose between two reddish-brown stripes. Northwestern Canada and Alaska from central Alberta north to Arctic coast and west to central Alaska.

Arctic Vole.—*Microtus macfarlani* Merriam. Size medium; tail short; color, dull yellow-brown and black. Tundra region of Arctic America east of Mackenzie river.

Richardson's Vole.—*Microtus richardsoni richardsoni* (DeKay). Probably the largest of American Voles, total length up to 9 inches; tail about as long as head; feet large; mammae eight; color dark brown. Rocky Mountain region of Alberta, Canada.

Prairie Vole.—*Microtus haydenii* (Baird). Medium size, soles thickly haired; tubercles on soles five in number; tail and ears short; grayish yellow-brown mixed with black above; mammae six. Plains region of western South Dakota, Nebraska, Kansas, eastern Colorado, Wyoming and southern Montana.

Oregon Vole.—*Microtus oregoni oregoni* (Bachman). Size very small; tail long; ears prominent; fur short and glossy; mammae eight. Pacific coast region from northern California to Puget Sound.

Pine Vole.—*Pitymys pinetorum pinetorum* (LeConte). Size small, soles hairy with five tubercles; mammae four; pelage short, close and glossy; ears short; tail short; above, russet, beneath, plumbeous washed with russet. Georgia and the Carolinas.

Pallid Vole.—*Lagurus pallidus* (Merriam). Size small; tubercles on soles of feet five in number; eight mammae; tail very short; ears well haired; above pale buffy gray mixed with black; beneath white. Prairies of western North Dakota, Montana, and north to Calgary, Alberta.

The Meadow Mice are probably the most abundant small rodents in North America, not only as regards individuals but also as regards number of species. There are no less than seventy-six species and subspecies north of the Rio Grande, not to mention a few that are found south of this boundary. This large number of different varieties is due to the great diversity of local surroundings in which Meadow Mice live. Being of a vigorous stock, they have pushed into almost every available economic niche.

In fact, the most remarkable thing about these troublesome little rodents, the Field Mice, as the farmers generally call them, is their ability to adapt themselves to the most widely differing environments. No matter, whether above the timber line on some snowclad Alaskan peak, or in the pine forests of Georgia; whether on the arid sand flats of the Painted Desert, or in the well-watered meadows of Pennsylvania—everywhere they seem to enjoy life. Under one set of conditions as under another, they present an equally sleek and well-fed appearance. Naturally the effect of environment is seen in the peculiarities of certain species, as, for instance, the brightening in color due to the effect of red soil.

"The vast range of this species has been noted," says David E. Lantz in "An Economic Study of Field Mice." "This Mouse has its natural habitat in moist meadows and grassy borders of swamps, but it habitually extends its range into neighboring cultivated fields, waste lands, and open spaces on the border of timber lands. Wherever it occurs, it is normally the most abundant rodent. Nearly all meadows are full of the animals.

"In swamps Meadow Mice nest in burrows in dry tussocks or in bunches of grass above the surface of the moist ground. The nests are composed of grass or fibers of weeds made into balls, loose and of coarser materials outside, but compact and of finer stuff within, each having a small opening on the side near the bottom. From this opening two or more trails diverge, one usually leading into an underground tunnel which opens at some distance from the nest.

Nests intended to receive the young are lined with the softest of accessible materials.

"The Meadow Mouse never lives in barns or outbuildings. Its nearest approach to human habitations is the stackyard or piles of wood or boards left on the edge of orchards or fields near houses. It is especially noted for long winter excursions from its summer abode, hiding its movements under cover of deep snow. The journeys of the animals are not suspected until the snow disappears, when the trails can be traced to great distances. They reach wheat, rye, clover and timothy fields and often extend into orchards, nurseries, lawns and gardens, all of which are injured by the animals. Haystacks or shocks of corn and other grain are sure to suffer if left out over winter."

Photograph by the American Museum of Natural History

MEADOW MOUSE

A well-mounted specimen showing not only characteristic attitude, but also distinctive markings of the fur

Field Mice of the genus *Microtus* have stout bodies, blunt rounded muzzles, small eyes, and short ears — often completely concealed in the fur. The tail is short and hairy; the soles of the feet are naked or clothed with short hairs, and have five or six foot pads. The incisors are broad and not grooved.

While the food habits of the various species of short-tailed Field Mice are remarkably similar, their breeding and general habits differ greatly. The variety of habitats is most striking. Some species prefer high ground, while others live in low, moist places. Occasionally the same species inhabits both sorts of localities. Some species live in forests, others in the open prairies. Some burrow under the ground like Moles, while others make smooth paths or trails upon its surface. Except in cold weather, nearly all species can temporarily adapt themselves to moist surroundings; but a few seem to be almost as aquatic as the nearly-allied Musk-rat.

The nests of Field Mice are compact bunches or globes, composed of grass blades and other dry vegetable fibers. They are placed in depressions in the ground, in shallow burrows, or supported on grass stems above the ground. In brush piles they have been found nearly a foot above the ground. Sometimes they are placed under flat stones or logs or under shocks of grain. The structures are so slight that a day's sunshine will dry them out after a storm, and

yet they are so compact that the animals pass the coldest weather snugly housed in them under the snow. Trails, often of great length and worn smooth by constant use, lead to neighboring feeding grounds.

While most surface nests are for shelter only, sometimes the young, especially of swamp species, are produced in them. However, the young of most kinds are born in underground nests and are rarely seen unless uncovered by accident. They are at first hairless and blind.

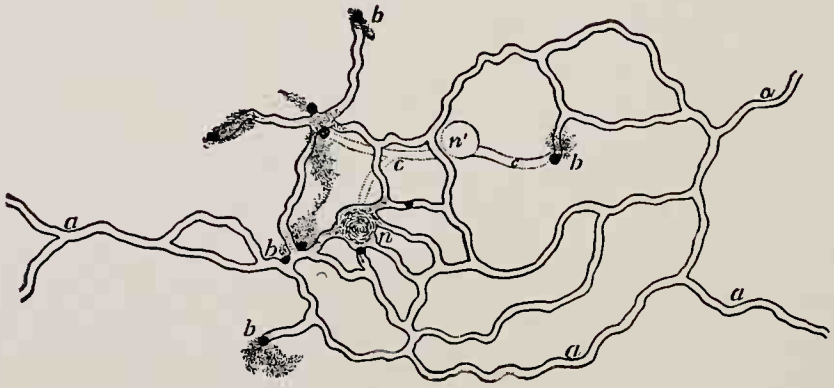
"The common Meadow Mouse of the United States is one of the most prolific of our species," says Lantz. "Estimating the normal increase at six young, with four litters in a season, and assuming that there were no checks upon the increase, the results are appalling. A single pair and their progeny in five seasons would amount to nearly 1,000,000 individuals. This calculation is under mark, since it is based on the assumption that the young do not breed until about a year old. The animals, however, mature very rapidly and the spring young undoubtedly breed in the fall of the same year.

"In summer the principal food of these Mice is green vegetation and unripe seeds of grain and grasses. As the season advances, ripe grain and seeds take the place of the immature; and in winter bulbous and other roots are in part substituted for stems and leaves. When convenient, and green vegetation is lacking, the bark of trees and shrubs becomes a staple food. It is mainly in winter that the apple orchards and young forest trees suffer from attacks of Mice.

"The quantity of green vegetation eaten by a single adult Field Mouse in the course of a year has been calculated at from twenty-four to thirty-six pounds. When one considers in connection with this estimate the great numbers of these animals in our meadows, swamps, and forests, the total quantity of food consumed by them appears so enormous as apparently to exceed the productive capacity of the soil. A thousand Meadow Mice in a meadow would require at least twelve tons of grass or other vegetation to maintain them for a year."

They are not especially partial to seeds, but flesh in any form is acceptable to them. They do not usually lay up food for the winter; but one Alaskan species has been seen to store roots. Certain peculiarities of habits are common to most of the species. "None are known to hibernate," says Vernon Bailey, "but in the north they have snug winter homes under the snow, where they move about freely in numberless tunnels. They burrow in the ground, and are famous for their little roads or smooth trails which run through the grass from burrow to burrow or away to their feeding grounds."

There seems to be no definite breeding season; nests with young in them have been found at all seasons of the year. Four to eight at a birth is the usual number. As the period of gestation is only about twenty days, and in temperate latitudes from four to six litters a year are produced, it will be seen that the annual increase must be enormous. The economic status of the Meadow Mouse is indeed a very important one; it has been carefully estimated that the Mice of the genus *Microtus* alone cause an average annual damage to the American farmer of at least $3,000,000. As Bailey says: "Too small and too numerous to be successfully destroyed



From a drawing by the U. S. Biological Survey

MEADOW MOUSE RUNWAY

An ingenious arrangement of branching tunnels made by the little animal both in search of food, and to provide an easy means of escape

by traps, guns, or poison, they prove one of the most difficult enemies with which the farmer has to contend. The work of a few animals is insignificant, but the work of millions makes heavy inroads on growing crops. In shocks of corn and wheat left for a long time the grain is often completely devoured. Even stacks of hay are often found in spring with the lower parts cut to chaff and filled with the nests of meadow mice." When the snow melts in the spring, trees and shrubs are found stripped of their bark for a wide space near the ground, and the marks of tiny teeth remaining in the hard wood show what animal has been at work. Sometimes apple trees ten to twelve inches in diameter are completely girdled.

Various protective measures have been adopted and suggested. Wire netting and tin cylinders placed around the bases of the trees are expensive, but they seem to give the best results. But obviously the greatest destruction of these pests should be wrought by their natural enemies, the hawks, owls, weasels, foxes, coyotes and minks, and if these become few, then the protection of other such enemies becomes doubly important, if we are to escape such devastating hordes of Voles as have swept over Europe.

Owing to their peculiar habits *Pine Mice* are not so well known as are Meadow Mice. Their natural habitat is the forest, although they are by no means restricted to pine woods or forested areas. While often inhabiting pine woods and the edges of adjacent fields, they live also in forests and copses of deciduous trees, usually on uplands.

The life of the Pine Mouse is largely spent in underground tunnels, which so closely resemble those of the Mole that generally they are mistaken for the work of that animal. The ridges of loose soil over the tunnel are exactly like those thrown up by the Mole, but the inner diameter of Mouse tunnels is less. Some of these burrows are utilized as nesting places. Nests are built also at the surface of the ground, under fallen logs, brush heaps, flat stones, fences, or other shelter. The number of young at birth evidently averages less than is usual in this family.

From their homes in woods and thickets Pine Mice invade fields, orchards, nurseries, dooryards, and gardens, passing always through underground runways. Living in concealment, neither their presence nor the injury they inflict is suspected until the latter is past remedy. Bulbs, planted hopefully in autumn, appear not at all in the spring, or only in the shape of sickly plants, whose life substance has been gnawed away. Nursery and orchard trees here and there put forth no leaves, and an examination of the roots discloses the nature of the damage.

Commenting further on their depredations, David E. Lantz, says: "Potatoes, sweet potatoes, carrots, beets and other vegetables are eaten by Pine Mice, both while growing and when stored in pits or lying in piles in the field or garden. Potatoes partly matured or left long in the ground after maturity are eaten, and the injury is attributed to Moles, because tunnels supposed to be the work of Moles lead to the place of damage. I have investigated numerous cases of such injury and have invariably found either that the tunnels were made by Pine Mice, or, if Mole tunnels, that they were frequented by Mice. Traps set in the tunnels at the potato hills captured Pine Mice, and the starchy material found in the stomachs of those caught proved that they, and not Moles, had been eating the potatoes."

The *Oregon Vole* is a rather small-sized Mouse of the Pacific Coast region ranging from Northern California to Puget Sound. It is found on dry, open ground, under cover of grass and low vegetation, and under logs in the open redwood forest of California.

The *Long-tailed Vole* is an inhabitant of the Yukon region found in various environments. Mr. Wilfred H. Osgood records that "at Glacier and Bennett they were secured on dry, rocky hillsides; at Lake Lebarge, they were taken in the kitchen of a log cabin; at Rink Rapids in an open, sandy place; and near Charlie Village on the side of a cut bank, where they had made burrows and runways among the exposed roots of trees."

Drummond's Vole is a species occurring from Hudson Bay to the west slope of the Rocky Mountains and Alaska. Mr. Edward A. Preble found it abundant in many parts of the Athabaska-Mackenzie region, where it did considerable damage about the trading posts, entering the houses freely. Another interesting species of this region is the *Yellow-cheeked Vole*, a large Mouse whose burrows were evidently quite deep, there being nearly a bushel of dirt at the entrance to a single burrow. Preble captured a female which would have borne eleven young ones. This species is quite active during the day.

RED-BACKED MOUSE

Evotomys gapperi (*Vigors*)

Other Name.— Red-backed Vole.

General Description.— A small, dark-colored Mouse, reddish along the back. Nose somewhat pointed; ears fairly large; body of normal proportions, neither slim nor thick-set; tail short, only about one-quarter total length; legs short; general color, chestnut along back, with buffy sides and underparts gray; hair rather long and quite soft.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical. *Summer.* A broad dorsal stripe extending from neck to tail, chestnut mixed with black; sides buffy ochraceous; underparts pale buff with the hairs dark plumbeous at base; feet silvery-gray; tail above, brownish, beneath, grayish-buff, tip black. *Winter.* Colors paler everywhere. Young: Slaty-gray and lacking a pronounced dorsal stripe.

Measurements.— Total length, 5.2 inches; tail vertebrae, 1.4 inches; hind foot, .7 inch.

Range.— Massachusetts, New Jersey and Pennsylvania northward, and from Atlantic Coast westward to Rocky Mountains in Canada.

Food.—Inclined to be omnivorous but feeding largely on seeds, berries, roots and bark of trees and shrubs.

Remarks.— Twenty-three species and subspecies are known, but all conform to the general type described above.

Related Species

Red-backed Vole.— *Evotomys gapperi gapperi* (Vigors). Typical animal as described above. Massachusetts, New Jersey and Pennsylvania northward, and from Atlantic Coast westward to the Rocky Mountains in Canada.

Rhoads's Red-backed Vole.— *Evotomys gapperi saturatus* Rhoads. Larger and longer tailed. Blue Mountains of Oregon, mountains of northern Idaho and northward into British Columbia to Caribou Lake.

Great Plains Red-backed Vole.— *Evotomys gapperi loringi* Bailey. Size very small, colors bright. Timbered valleys along edge of plains in Minnesota and eastern Dakotas.

Dawson's Red-backed Vole, or Arctic Red-backed Vole.— *Evotomys dawsoni dawsoni* Merriam. Size large; tail short; bright rusty red above. Finlayson River and Fort Laird west to Yakutat and Juneau, and north along the coast to Prince William Sound.

Labrador Red-backed Vole.— *Evotomys proteus* Bangs. Size large; sepia above; below, light smoke-gray; total length nearly seven inches. Labrador.

The Red-backed Vole may be easily distinguished, in the case of adult animals, from the more common Meadow Mouse by the broad, chestnut-colored stripe extending along its back the entire length. It is also a smaller animal, with softer quality of fur and larger ears. However, it is a very close relative of the Meadow Mice. This group is of northern distribution, most of the species being found only in the mountains or in high altitudes.

In many regions the Red-backed Mouse is the most abundant of mammals. It is fond of mossy places, and is captured more frequently under decayed logs than in any other situation.

Gapper's Red-backed Mouse, of which there are more than half a dozen varieties, is the species most common in the Eastern States, from Pennsylvania and New Jersey northward to Canada. In the Hudson Bay region, around Fort Churchill, Mr. Edward A. Preble found mossy spruce woods to be its favorite habitat, although he trapped it also in mixed woods, and occasionally in willow thickets in swamps.

Rhoads's Red-backed Vole is a larger and longer-tailed variety. It lives in the sphagnum bogs of the Northwest, which are frozen for several inches below the surface in the winter; hence it must subsist on the food it has stored in its underground galleries. It is a hardy and an active animal.

The *Dawson Red-backed Mouse* is a handsome species ranging from northwest Territory west to Juneau. About Great Bear and Great Slave lakes, Preble found some of these animals "living among the rocks on the semi-barren tracts near the shore and feeding largely on the cranberries." Mr. Wilfred H. Osgood, who traversed the whole length of the Yukon river in 1899, says: "Red-backed Mice are by far the most abundant mammals in the Yukon region. Specimens were trapped in all sorts of localities; along cold streams, under logs, in heavy moss, in *Microtus* runways, and among rocks. We occasionally saw them during the day, and often heard them rustling the dead leaves on the ground about us as we lay in our blankets at night. They are the vermin of the miner's larder, and are always to be found about log cabins."

By permission U. S. Biological Survey

Drawing by E. J. Sawyer

COMMON MUSK-RAT

In general structure this rodent is a true Rat; but in shape and habits it may be called the little brother of the Beaver

MUSK-RAT

Ondatra (or Fiber) zibethica (*Linnaeus*)

Other Name.— Musquash.

General Description.— A large rat-like rodent with long, naked, vertically compressed tail. Head broad and blunt; ears almost hidden in long fur; body thick-set, heavy; tail long, about one-half total length; legs short; hind feet specialized, long, with toes partly webbed; tail much deeper than wide, almost naked and scaly, with scattered long hairs; pelage of two coats, a dense soft underfur and long outer coat of hard glistening hairs.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical. Seasonal variation very slight. General color dark chestnut brown above; underparts brownish-white; underfur everywhere slaty-black; throat whitish; chin with brown spot; feet brown; tail blackish-brown; individuals vary from this pattern to much darker. Young: Slaty-gray.

Measurements.— Total length, 21 inches; tail vertebrae, 10 inches; hind foot, 3.5 inches. Weight, 2 pounds, 4 ounces.

Range.— Southeastern Canada, northeastern and east central United States.

Food.— Quite omnivorous; besides many types of vegetation such as stalks and roots of flags, lilies and reeds, considerable animal food is eaten, mainly clams, fish and insects.

Remarks.— The Musk-rat is in reality only a highly specialized, enlarged Vole, and this relationship is shown in a number of characters. They are widely spread over North America from northern Mexico to the Arctic Coast, and have become differentiated into fourteen species and subspecies, of which only a few need be cited below.

Related Species

Musk-rat.— *Ondatra zibethica zibethica* (Linnaeus). Typical animal as described above. From New Brunswick and Quebec west to Minnesota, south to northern Georgia, Arkansas, and south along Atlantic seaboard to Delaware Bay.

Large-toothed Musk-rat.— *Ondatra zibethica macrodon* (Merriam). Color darker and richer; teeth larger than common Musk-rat. Middle Atlantic Coast region of the United States.

Labrador Musk-rat.— *Ondatra zibethica aquilonia* (Bangs). Smaller and blacker than the common Musk-rat. Labrador.

Pallid Musk-rat.— *Ondatra zibethica pallida* (Mearns). About two-thirds as large as common Musk-rat; coloration paler. Colorada River Valley, California, and Arizona, east to the Rio Grande Valley in New Mexico.

Oregon Musk-rat.— *Ondatra zibethica occipitalis* (Elliot). Largest of the Musk-rats; coloration dark. Northern Willamette Valley and coast of Oregon.

Photograph by S. A. Lottridge

YOUNG MUSK-RAT

Everything is food that comes to the Musk-rat's table

A few years ago a country boy was crawling quietly along through the tall grass and low bushes bordering the edge of a mill pond. As he peered over the tops of the grass he saw just above the surface of the water a brown rat-like head and behind it a series of little rippling waves. The boy crouched and watched with all his eyes. Splash! The animal had dived, only to reappear in a few minutes, upon a shelving rock with a fresh-water "clam" in its mouth. It opened the shell and ate its contents with seeming relish. When its meat course was finished it nosed along the bank for a rod or two, and, finding a plant to its taste, dug into its root with a few slashing strokes of its strong fore-legs, and ate its vegetable course with quite as evident gusto.

"My land!" breathed the boy to himself, "what a whopper of a Musk-rat!"

On another magic day the boy was fortunate enough to see a second Musk-rat swimming back and forth near the bank followed by four smaller copies of herself. Slowly the light faded and he could see them no more; but, as he stood up and turned to go home, he heard the slap of the Rat's tail on the water, warning others of her kind that danger threatened; then slap after slap around the pond as others heard the alarm and passed it on.

A few days later the boy set traps at the mouth of the Musk-rats' burrows in the bank of the pond. They were rather small steel traps, and he sank them into the mud and also in the shallow water near the shore. Then he impaled a small carrot on one end of a slender stick and pushed the other into the ground at such an angle that the carrot came just above the pan of the trap, and high above it so that the Rat would have to stand upright in order to reach the tempting morsel. Oftentimes he caught his Musk-rat in this manner, although sometimes he found only the lower part of a leg in the trap. In its struggle to escape the Musk-rat had twisted or gnawed off its own leg.

Photograph by Dr. R. W. Shufeldt

MUSK-RAT FEEDING

A rodent that is more at home in water than on land. Large numbers are killed for the sake of their fur

If he had been an Indian boy along the Yukon River of Alaska, a Creole boy in Louisiana, the son of a lumberman in Maine, or a gold miner in the Rocky Mountains, this boy's experience would have been much the same; for the Musquash — as the Musk-rat is sometimes called — is found practically all over North America as far south as the Mexican boundary. No single species, however, is so widespread. The common eastern form, with its subspecies covers most of the entire range. Of two other important species, one is found in Labrador and the other in southern Louisiana and Mississippi. Some of the subspecies are much restricted in range. The *Large-toothed Musk-rat* is confined to the region on and near the coast of Delaware, Maryland, Virginia and North Carolina. The *Oregon Musk-rat* is limited to the

northwestern coast region of Oregon and the southwestern part of Washington.

In general structure and in the character of the teeth, the Musk-rat is simply a great Mouse; but in shape and habits it is a small edition of the Beaver. In fact, Linnaeus put it into the same family genus with the latter. However, it is much smaller than the Beaver, and the tail is entirely different, that of the Beaver being very broad and flattened laterally, while that of the Musk-rat is narrow and flattened vertically. This flattening enables the Musk-rat to use it both as rudder and propeller. The hind feet are slightly webbed and assist in swimming.

Photograph by William Brewster (U. S. Biological Survey)

MUSK-RAT HOUSE

These resemble Beaver houses, but are smaller. An elaborate system of tunnels is within

Anyone who has visited marshy ponds and sluggish shallow streams has noticed the conical piles of mud and vegetable matter which extend from a foot to three feet above the surface of the water. These are Musk-rat houses, similar to, but smaller than, Beaver houses. The method of building these is rather unusual. A pile of mud mixed with plant stalks is brought together in a place where the water is about two feet deep. When the pile is sufficiently large, the Musk-rat makes a tunnel from the bottom upward, and hollows out a chamber just below the upper surface of the dome, or through it in some cases, so that only a few plant stalks stick out above. More mud and stalks are placed on top of the chamber, as the roof sinks, until the whole house is firm. The single main room may be a foot or more in diameter and sufficiently high to enable the owners to move about freely. Sometimes there are two main chambers, each with its own entrance, but they are probably occupied by different families. These houses are chiefly used in winter. Work of repairing old houses and erecting new ones begins in early summer, in order that they may be snug and shipshape when ice begins to form.

In summer an elaborate system of tunnels and chambers is used for refuge and for breeding. The mouths of these tunnels start well under the surface of the water and lead upward gradu-

ally to the chambers above water level, and often beneath the roots of trees. Small ventilation holes connect these rooms with the ground surface. Sometimes channels extend from the burrow entrance out into the deeper water, so that the Musk-rat is more secure as it approaches its home. Such channels are very prominent when the water in a pond dries up. Short tunnels ending in a chamber are sometimes made at intervals along the edge of a pond, to be used as retreats from danger when distant from home.

Photograph by the U. S. Biological Survey

MUSK-RAT FEET

The partially webbed structure of the hind feet of a Musk-rat aids it greatly in swimming

The Musk-rat believes in "safety first," for it avoids the attacks of many of its land enemies — such as Foxes — by building little islands or rafts of sticks, cattails and other plant stalks, on which it sits when eating. An enemy must come from the air or water to be dangerous. From the former it escapes by slipping quickly into the water. From the latter there is little chance of getting away. These rafts are kept stationary by being built around cattails or other plants growing in such places. In winter, ice does not cover these rafts completely, but snow soon roofs them over, and they serve as breathing holes when the Musk-rats are swimming under the ice in search of food, for they do not hibernate to any extent.

Everything is food that comes to the Musk-rat's table. Roots, stems, leaves of various water and swamp plants furnish the larger part of its bill-of-fare, while heaps of fresh-water mussel-shells (clams), at convenient landing places along the water's edge, testify to its fondness for flesh. Fish, frogs and other aquatic animals also form part of its diet.

When the snow and ice have melted and the warm spring rains have covered the land with the tender green of awakening vegetation, the Musk-rats mate, and savage fights may take place for the possession of a desired female. The four to twelve young are born in early May in the latitude of the Eastern States, and are blind and helpless, but in about three weeks have grown so rapidly that they can nearly care for themselves. This is necessary, for a second and even a third litter may follow them during the summer. In some localities four or five litters are said to be produced in one breeding season. By the end of the summer the young of the first lot are able to raise families of their own.

It is fortunate for them that Musk-rats are so

prolific. Otherwise, they could hardly hold their own against their many enemies. To live a long life a Musk-rat must be ever on the alert. Some of the larger hawks and owls attack it from the air; wolves, foxes, lynxes, weasels, wolverines and many other animals prey upon it when it ventures on land; otters and mink are able to follow it in the water; and the bigger members of the pike family may seize it from below. The mink, however, is the worst of these, for it can follow the Musk-rat into its home. Like the Beaver, the Musk-rat is most susceptible to attacks from its land enemies when it goes on voyages of discovery from one body of water to another, as it often does in late fall. It is no coward and will fight to the death. It has been known to attack even a man when cornered far from a place of refuge.

To see the Beaver at its work one must usually go far from civilization; but the Musk-rat is at home in any small pond, bit of swamp, or deep brook within a few rods of one's house. A little quiet watching in the late afternoon will enable any village dweller to become rather intimately acquainted with this hardy and interesting neighbor.

Many may not know the Musk-rat so well in life, as after death. Then it comes into closer contact, as its dense under hair-covering makes it of value for fur. Several million skins are taken annually, and, after being dyed, are sold under such names as "electric seal", or "Hudson seal."

The damage done by the Musk-rat is very slight. Sometimes it tunnels into dams and dikes and weakens them. In ornamental ponds it occasionally eats the roots and stems of water-lilies and other aquatic plants.

J. M. JOHNSON.

ROUND-TAILED MUSK-RAT

Neofiber alleni *True*

General Description.— A large, rat-like rodent much resembling the Musk-rat, but having a round tail. Size smaller than latter; head rather blunt; ears inconspicuous; body somewhat robust; tail long, nearly half total length, round, tapering gradually to tip; legs of moderate length; feet normal; toes not bent laterally at angle with the sole; soles naked, narrow, smooth, with five tubercles; conspicuous side glands present; general color rufous, lined with black; below white tinged with rufous.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— ADULTS: Sexes identical, seasonal variation inconspicuous. Pelage long, above rufous lined with black, the hairs with lead colored bases; head darker; hairs back of shoulders white at base; underparts light rufous with bases of hairs lead color; chin, throat, inside of legs, whitish or tinged with rufous; tail and feet dark brown. YOUNG: Blueish-gray on back; pale plumbeous beneath.

Measurements.— Total length, 13 inches; tail vertebrae, 5 inches; hind foot, 1.5 inches.

Range.— Eastern and central Florida.

Food.— Green vegetation, roots and some animal food.

Remarks.— There is only the one species. This animal appears to be somewhat intermediate between the little Meadow Mice and the more highly specialized Musk-rat, and is known only from a very limited range.

While called a Musk-rat, this less familiar animal occupies a group by itself, intermediate between the smaller Mice and its big cousin the common Musk-rat. It is very large for a Mouse, but small for a Musk-rat, since it is slightly over one-half as long as the latter. It is at home in both the fresh and salt-water ponds, and marshes of Eastern Florida. A large oval nest, resembling the common Musk-rat's, is built in water, and projects above the surface. Sometimes nests are built in the mangroves or in hollow stumps.

It also constructs platforms on which it sits while feeding. The food consists largely of grasses and other vegetable matter, although it does not disdain clams, and other marine forms that can be easily captured.

Many of its habits are similar to those of the common Musk-rat. It is a quick, alert animal, though perhaps not so industrious as its Northern cousin, as the warmer climate naturally leads to sluggishness, and it does not have to build such snug retreats against the approach of winter. It raises large and frequent families, whose members are much sought after, by such unwelcome guests as hawks, owls, foxes and the larger fish. The young that escape quickly attain maturity in the warm climate.

THE FAMILY OF POCKET RATS

(Heteromyidæ)

POCKET Rats are placed in a separate family because of well-defined variations from other Rats, the chief difference being indicated by the name. This is an interesting group of small rodents characterized, like the Pocket Gophers, by cheek pouches which are used for carrying food. They are the only North American animals, excepting the Gophers and the Jumping Mice, which have these pockets. They include the Pocket Mice, which are usually plains-loving animals, and the Pocket, or Kangaroo Rats, characterized by enormously developed hind legs. These rodents have narrow incisor teeth, rootless molars, and very large mastoids. Their hind feet are long, and they have either four or five toes. The pelage is generally soft, but in a few species the finer hairs are mixed with spiny bristles. Although a numerous and widely scattered family they are not popularly known, or even distinguished from common forms.

POCKET MOUSE

Perognathus fasciatus *Wied*

General Description.— A small Mouse with a large head, external cheek pouches, and rather a long tail. Head broad; eyes fairly large; ears medium size; hind legs elongate; tail well-haired and with a tuft of longer hair at the tip; pelage rather long, soft and glossy. Strictly nocturnal, an inhabitant of the open plains.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{1-1}{1-1}$; Molars, $\frac{3-3}{3-3}$=20.

Pelage.— ADULTS: Sexes identical. Seasonal variation slight. Above, olive-gray tinged with pale fulvous and lined with black; pale fulvous lateral stripe; feet and underparts white; two light yellow patches on ears and a larger patch behind ears; tail paler below than above. YOUNG: Lacking the yellow and black of the adult pelage.

Measurements.— Total length, 5.5 inches; tail vertebrae, 2.5 inches; hind foot, .7 inch.

Range.— Plains of eastern Montana and Wyoming, eastward into North and South Dakota.

Food.— Seeds, grain and other vegetable matter.

Remarks.— Considerable variation is found in color, size and character of pelage, some of the Pocket Mice having well developed spines among the softer hairs of the back. There are some 50 species and subspecies ranging north of the Rio Grande.

RELATED SPECIES

Great Plains Pocket Mouse.— *Perognathus fasciatus fasciatus* Wied. Typical animal of the above description. Montana, Wyoming, North and South Dakota.

Yellow Pocket Mouse.— *Perognathus flavescens flavescens* (Merriam). Pale yellowish-brown lined with blackish above. Plains of South Dakota, Nebraska and Kansas, west to base of Rocky Mountains, and south to Texas.

Panamint Pocket Mouse.— *Perognathus panamintinus panamintinus* (Merriam). Total length, 6 inches; tail longer than head and body; ochraceous to grayish-buff above. Panamint Mountains, California, eastward through southern Nevada to St. George, Utah.

Pacific, or Least Pocket Mouse.— *Perognathus pacificus* Mearns. Smallest of Pocket Mice and one of the smallest mammals known; total length, 4.3 inches; above ochraceous buff thickly mixed with black. San Diego County, California.

Northwest Pocket Mouse.— *Perognathus lordi lordi* (Gray). Large; tail longer than head and body; slaty-buff strongly mixed with black. Plains of Columbia River, Washington, and southern British Columbia.

Hispid Pocket Mouse.— *Perognathus hispidus hispidus* Baird. Size large; brownish-black and cinnamon; pelage harsh. Texas north to Oklahoma.

Spiny Pocket Mouse.— *Perognathus spinatus spinatus* Merriam. Size medium; drab-gray lined with black; spines on rump. Desert region of southern California.

The Pocket Mouse is a peculiar and interesting little fellow, whose nearest relative is the Pocket Rat, or Kangaroo Rat. The latter, in fact, may be called his big brother, so closely do they resemble each other. The Pocket Mouse belongs to a different family from the Meadow Mice and White-footed Mice, and may be easily distinguished from others by the external cheek pockets. Nearly all members of this group live in the desert or arid plains, and they are most numerous in the Southwest.

Few persons are at all familiar with this little rodent, and when one mentions the fact that there are a half hundred species of these odd-looking little creatures, the surprise of the listener grows apace. With the exception of the Pocket Gophers and the Jumping Mice, the Pocket Mice and Rats are the only North American mammals that have the pouches which give them their name. These serviceable receptacles, which are placed in the skin of each cheek, are hair-lined, have somewhat narrow openings, and extend back almost to the ears. In them their possessors carry seeds and berries of various kinds, often stuffing the pockets quite full.

Most of the species are inhabitants of the plains and the prairies, but a few make their homes in the interstices of rocks. In Texas, Merritt Cary caught one under a pile of rocks at the east base of the Davis Mountains at an altitude of about 5000 feet. Speaking of the *Yellow Pocket Mouse,* Vernon Bailey says: "At El Paso these little Yellow Pocket Mice were common in December, along the edges of the sandy valley bottom two miles below town, where little sand drifts were heaped up around the base of *Atriplex* and *Suaeda* bushes. Their burrows were usually in groups of three or four, under the edges of the bushes. The occupied ones were closed, and were discovered only by following the lines of tiny footprints across the bare patches of sand from bush to bush, till they disappeared at little mounds of fresh earth that served as doors and blinds to the underground houses. By scraping away the earth, a burrow big enough to admit a little finger was disclosed under each tiny mound. On chilly nights they did not move about much, but on mornings following a warm night their lines of tracks were abundant. One specimen caught December 15, was apparently nursing young."

All of the species are nocturnal, and, as far as known, none of them hibernate. When caught, "they do not offer to bite, but sometimes

Photograph by U. S. Biological Survey

POCKET MOUSE

Although very numerous in some localities, it is surprising how few people know about the remarkable features which differentiate these from ordinary mice

utter a fine squeak, and if held gently for a while soon cease struggling and seem to lose all fear. The light evidently hurts their eyes, and after blinking for a while they soon close them, if held quietly in the hands or placed in an undisturbed position on the ground."

The typical *Great Plains Pocket Mouse* is sometimes called Maximilian's Pocket Mouse, from the fact that it was first discovered by Maximilian, Prince of Wied, on a journey up the Missouri river, and described by him in 1839. One of the smaller members of the genus, it is easily distinguished by the olive-gray color of its upper parts.

The smallest of the group is the *Pacific* or *Least Pocket Mouse,* found on the shore of the Pacific Ocean, San Diego county, California. It is but little over four inches long.

A very curious species is the *Spiny Pocket Mouse,* a desert Mouse of southern California and northern Lower California. It has spines bristling on the rump, scattered on the flanks and sides, and often extending to the shoulders.

From the contents of the pouches in animals that have been trapped it is found that these Mice feed on seeds of all kinds. Juniper berries, corn, millet, planted peas, and cantaloupe seeds seem to be favorite items in the dietary of several species. Bailey says: "In a number of burrows I found juniper seeds, or the empty shells from which the kernel had been eaten out through a little hole in one end. In some cases these berries must have been brought from a distance of ten or twenty rods. In one den under a flat rock, where three tunnels, a foot to a foot and a half long, met in a nest chamber the size of my fist, there was a handful of fresh juniper seeds carefully cleaned of the outer pulp."

The enemies of these Mice are the usual enemies of the Mouse kind. The skin of a Pocket Mouse has been found in a burrowing owl's nest; and several rattlesnakes, on dissection, were found to have preyed upon other members. Domestic cats often bring them in, and they are often turned up by the plough.

POCKET RAT

Perodipus agilis *Gambel*

Other Name.— Kangaroo Rat.

General Description.— A thick-set rodent with very long tail and hind legs, having external cheek pockets. Head large and broad; whiskers long; eyes large; ears broad and rounded; tail thickly clothed with short hairs and terminating in a tuft; fore legs short; hind legs enormous, kangaroo-like; pelage exceedingly soft and silky. A nocturnal rodent living in burrows in the plains or desert areas.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{3-3}{3-3}=16$.

Pelage.— Adults: Sexes identical. Seasonal variation inconspicuous. Above, yellowish-brown mixed with black, the hairs slate-gray for the basal half or three-quarters; sides ochraceous-buff; below, clear white; spot over eye and behind ear, side of nose, and stripe running across hips and along each side of the tail to the end, white; a black crescent across sides of nose just before eye; tail above, blackish with blackish tip, paler below. Young: Quite similar to adults, but colors not so contrasting.

Measurements.— Total length, 11.3 inches; tail vertebrae, 7.1 inch; hind foot, 1.6 inches; ear .5 inch.

Range.— Middle and southern California.

Food.— Strictly vegetarian; seeds, grain and miscellaneous vegetation.

Remarks.— There are three genera, further described below, containing 45 species and subspecies. The more important species of each genus follow.

Related Species

Gambel's Pocket Rat.— *Perodipus agilis agilis* Gambel. Typical animal as described above. Middle and southern California.

Ord's Pocket Rat.— *Perodipus ordii ordii* (Woodhouse). Size medium; tail shorter than Gambel's Pocket Rat. From Snake Plains south to New Mexico and Arizona.

Richardson Pocket Rat.— *Perodipus richardsoni* (Allen). Larger than Ord's Pocket Rat. Ochraceous-buff lined with black. Oklahoma.

California Four-toed Pocket Rat.— *Dipodomys californicus californicus* Merriam. Size large, color dark. Northwestern California.

Desert Pocket Rat.— *Dipodomys deserti deserti* Stephens. Very large and pale; total length, 13.5 inches. Mojave and Colorado Deserts, California.

Spectacled Pocket Rat.— *Dipodomys spectabilis spectabilis* Merriam. Size very large; ochraceous-buff lined with black above, a black crescent on sides and top of nose just before eyes. Texas and Arizona eastward to Sierra Blanca, Texas.

Merriam's Four-toed Pocket Rat.— *Dipodomys merriami merriami* Mearns. Above gray tinged with pinkish buff; size rather large. Arizona.

Pygmy Pocket Rat.— *Microdipodops megacephalus megacepholus* Merriam. Size small; tail not tufted at tip; head large; above, yellowish-brown mixed with black and olive; total length, 6 inches; tail vertebrae, 3.2 inches; hind foot, 1 inch. Central Nevada.

It is unfortunate that the name "Kangaroo Rat" has become attached to this group of beautiful rodents; for, as Bailey says: "they are as unratlike as they are widely removed from the Marsupials." The Kangaroo Rats have been termed the "handsomest Rats or Mice in the new world"; and few persons who have seen them will be inclined to dispute the correctness of this characterization. They are really very pretty creatures, with large, expressive eyes, and their fur is as soft as silk and of pleasing coloration. Like the Pocket Mice, they possess external hair-lined cheek pouches, and their skull is no thicker than a sheet of paper. As their name implies, they have the appearance of tiny Kangaroos, and their mode of progression resembles that of their namesake. The tiny "hands" and the tail are not apparently used in locomotion. Loring, who turned loose one that he had caught, noticed that "while jumping, its tail was slightly curved up and was not used in any way to aid in its progress."

Kangaroo Rats live in colonies, and excavate burrows. They do not hibernate, but they carry considerable food into their chambers, to be consumed during the day or, possibly, in bad weather. They seem indifferent to extremes of temperature, and flourish equally in hot and arid valleys and when running about on the snow. The absence of water seems to cause them no inconvenience, and they find subsistence where vegetation is most scanty.

These beautiful little rodents are closely related to the Pocket Mice which they resemble in the possession of cheek pouches, but they are a great deal more highly specialized. The very long hind legs and tail, in combination with the thick-set body and soft fur characterize this animal so well that it can be confused with no other group of rodents. There are three genera of Pocket Rats known. The genus *Perodipus*, having five toes on the hind feet and including some twenty-three species and subspecies; the genus *Dipodomys*, with hind feet having four toes only but otherwise almost identical with the first genus and containing some eighteen

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KANGAROO RAT

The reason for the name given to this little rodent is shown in the above statuesque photograph from life

By permission of the New York Zoological Society

GAMBEL'S POCKET RAT

A native of middle and southern California, a typical member of a group noted for its cheek pouches and Kangaroo-like legs. Photograph nearly life size

species and subspecies; and the genus *Microdipodops,* much smaller than either of the other two genera and containing four species.

The fifth toe of the genus *Perodipus* is so small that for a long time it was not discovered by the naturalists. Of the five-toed group, one of the best known is *Gambel's Pocket Rat* described above. One of the largest and handsomest is *Richardson's.* According to Bailey, it "fairly revels in the mellow soil of the yellow, shifting, naked drifts and dunes that the wind piles up along the edges of the river valleys." It scampers over the smooth surface with the apparent enjoyment of boys on a skating pond; sometimes it hops but a few inches, but often takes leaps of four to six feet. It makes large burrows, and "they go back horizontally, so that in case of a hard rain the water runs out of instead of into them." Its food is almost entirely seeds, which are always "neatly shelled out and eaten on the spot, or carried in the ample cheek pouches to the dens to be eaten at leisure." Unless the animals become more than usually numerous, Bailey considers "their depredations too insignificant for consideration."

The largest of the four-toed species is the *Spectacled Pocket Rat,* so called because of the peculiar marking around the eyes. Bailey thus describes their habits: "Although strictly nocturnal animals and rarely seen alive, these Kangaroo Rats usually make their presence evident by conspicuous mounds scattered here and there over the barest and hardest of gravelly mesas, mounds as characteristic and unmistakable as Musk-rat houses or Beaver dams, and as carefully planned and built for as definite a purpose —home and shelter. An old mound that has been inhabited for years is often three or four feet high and ten or twelve feet wide. Usually one or more of these doorways are closed each morning with earth behind the retiring inmates, probably to keep out rattlesnakes and other unwelcome guests. The animals are social. Often three or four are caught in a mound. When caught in traps or in the hands, the animals struggle violently, but never make a sound or offer to bite."

Photograph by Dr. R. W. Shufeldt

RICHARDSON'S KANGAROO RAT

A specimen photographed from life, in a Kansas wheat field

Merritt Cary in "A Biological Survey of Colorado" says, "Kangaroo Rats are stated to have been numerous in Colorado some years ago when only small areas were under cultivation. At that time they were very injurious to crops, digging up large quantities of newly planted grain and caching it in their burrows along the sandy margins of the fields, and also feeding extensively on tender green stems of wheat. The burrows are usually beneath bushes, or in beds of prickly pear, and more rarely under the large

Rabbit brush. There are usually from three to six entrances to a nest, each entering the ground at an angle of less than 45 degrees, sometimes nearly horizontal, and usually from different directions."

The typical home of the Kangaroo Rat is sandy river bottoms or on the numerous sand ridges scattered here and there over the plains. It is seldom found living in hard soils, but often takes up its abode in cultivated fields. The more or less horizontal burrows are excavated beneath bunches of prickly pear, yucca, and sage-brush, or in the banks of blow-outs and railroad embankments. The animals are nocturnal and most active during the latter part of the night. During the day the burrows are often closed from within, but early in the morning they are usually found open, with a quantity of freshly ejected sand at the entrances.

Little is known of the breeding habits of these animals; but of ten females of the *Ord Kangaroo Rat*, caught in New Mexico between November 29 and December 6, four were nursing young. At the same time numbers of nearly full-grown young were caught, "which would indicate either that two litters are raised in a season or that the breeding season is very irregular."

The *Pygmy Kangaroo Rat* is, as its name indicates, a very much smaller animal than either of the two other genera mentioned above. The hind feet are densely coverd with fur to the tips of the toes, and the ears are completely covered with soft fur. It is a habitant of Central Nevada.

All of the Kangaroo Rats are the prey of owls and snakes, especially rattlesnakes. One specimen was found "in the throat of a large rattlesnake that had swallowed it as far as the trap would permit." According to William Lloyd, who camped near Brownsville, Texas, they enjoy moonlight nights. On several occasions he saw them skipping about and they came close up to his bed. A lighted lantern seems to bother them greatly.

Photograph by S. A. Lottridge

JUMPING MOUSE

Jumping mice prefer the open grassy country, although species are found in widely varying localities

THE FAMILY OF JUMPING MICE

(Zapodidæ)

JUMPING Mice have several strong marks of distinction which enable even the ordinary observer to separate them from all other rodents. They are slender and graceful Mice with exceptionally long tails, short fore legs, extremely long hind legs which have given them their other name of Kangaroo Mice, and cheek pouches. Probably no other family of animals has more evident peculiarities. Like the Kangaroo, their muscular hind legs give them remarkable jumping powers, while their tails aid to balance them and give them direction. This family of rodents have the upper incisors compressed. The premolars are small, and the molars rooted. The hind foot has five separate toes. The tail, which is longer than the body, is slender and scantily haired. The family is widely distributed over North America, there being twenty-one species and subspecies, found from Canada to North Carolina, and westward to the Pacific Coast.

JUMPING MOUSE

Zapus hudsonius *(Zimmermann)*

Other Name.— Kangaroo Mouse.

General Description.— A medium-sized Mouse with rather harsh pelage and extremely long hind legs and tail. Head of normal proportions; nose pointed; ears small; body inclined to be thick-set; tail slender, tapering and sparsely covered with hair; hind feet enormously elongated; toes five in number on both fore and hind feet; pelage rather harsh because of the long, somewhat coarse, outer hairs. Hibernates in winter.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{1-1}{0-0}$; Molars, $\frac{3-3}{3-3}=18$.

Pelage.— ADULTS: Sexes identical. Seasonal variation occurring but not especially conspicuous. Above, strong ochraceous yellow mixed with blackish along the dorsal line; sides a brighter yellow; underparts and feet white, meeting the color of sides in a sharp line; tail above, dark, beneath, whitish; pelage composed mainly of a shorter coat with many long, coarser hairs. YOUNG: Like adults but lacking the well-defined dorsal band of blackish mixed with ochraceous.

Measurements.— Total length about 8 inches; tail vertebrae, about 5 inches; hind foot, 1.2 inches.

Range.— From southern Hudson Bay region south to New Jersey and North Carolina, west to Iowa and Missouri, and northwest to Alaska.

Food.— Green vegetation.

Remarks.— The only members of their family found in North America, the Jumping Mice are so well characterized as to need a critical comparison with no other Mice. Twenty-one species and subspecies are found in North America. Differentiation has taken place along the lines of color variation and size differences as well as in cranial structure. The group is a semi-boreal one, that is to say, it is found only in the mountains, in the higher latitudes, or in regions with climate temperate or colder. It is not known south of the United States.

RELATED SPECIES

Jumping Mouse.— *Zapus hudsonius hudsonius* (Zimmermann). Typical animal of the above description. From southern shores of Hudson Bay south to New Jersey, and in the mountains to North Carolina, west to Iowa and Missouri, and northwest to Alaska.

American Jumping Mouse.— *Zapus hudsonius americanus* (Barton). Smaller. From Raleigh, North Carolina, to southern Connecticut and lower Hudson Valley along the coastal plain.

Great Plains Jumping Mouse.— *Zapus hudsonius campestris* Preble. Size large. Great Plains from Manitoba to Nebraska, and westward to Colorado and Wyoming.

Rocky Mountain Jumping Mouse.— *Zapus princeps princeps* Allen. Size large, color yellowish-brown instead of ochraceous-brown. Rocky Mountain region from Northern New Mexico to Alberta.

Pacific Jumping Mouse.— *Zapus pacificus* Merriam. Size large, coloration very bright. Interior valleys of southwestern Oregon and northwestern California.

Woodland, or Canada Jumping Mouse.— *Napaeozapus insignis insignis* (Miller). Lacks the premolars found in true *Zapus;* size large; coloration pale; tail white tipped. Eastern Canada south to western Maryland.

The Jumping Mice are among the most interesting and remarkable of our small mammals. From their long and strong hind legs and long tails they have been called Kangaroo Mice, a name for which their extraordinary leaping powers give some justification; but the popular idea that, like the Kangaroo, they have a pouch in which they carry their young, is erroneous. More than a score of species and subspecies of these little animals are recognized, and, with one exception, a Chinese cousin, they all belong to North America, being distributed over the continent and found at such widely distant points as Labrador, Alaska, California, and North Carolina. The members of the Canadian group are generally to be found in dense woods not far from streams, but all of the other species delight in meadows, shrubby fields, and thickets along the edges of woods, and show a marked preference for moist locations.

All of these Mice hibernate; but some of them, emulating the Skunk and some Bears, will awake and come out in unusually mild winter weather. Usually they pass six months or more in a dormant state. They will sometimes store food in their nests in the summer months, but it has not been satisfactorily determined when this food is used.

The nests are usually holes in the ground, sometimes only a few inches, and sometimes two or three feet, below the surface, and occasionally they are found in hollow trees. Here the young (generally five or six) are born, in May or June, and sometimes as late as September.

It would be difficult to decide just how far one of these animals could jump. They have been known to cover as much as six or eight feet, but statements crediting them with the ability to leap four or five yards must be received with suspicion. When even six feet is considered in relation to the little acrobat's own length, little more than half a foot, it will be seen that it can cover a distance at least twelve times its size.

Mr. Edward A. Preble, writing of the habits of the common Jumping Mouse, says: "During the summer, they are often seen in meadows and fields, and are more readily detected during the haying season than at other times, when they are driven from their hiding places while the grass is being cut. When disturbed, they move off by a series of frog-like leaps, and often remain motionless after a jump or two, especially when frightened from a nest. In leaping they are greatly assisted by their long tails, which aid in preserving their balance, as in the case of other animals similarly endowed. If, by any accident, a portion of the tail is lost, the power of balancing is greatly impaired, and the animal, if startled, seems unable to pursue a direct course because of failure to land properly on its feet. In their chosen haunts these Mice do not follow beaten paths or runways, like many small mammals, notably Meadow Mice, but seem to wander rather indiscriminately, availing themselves to some extent of natural pathways or open places."

The nest of this species is globular and about four inches in diameter, and has a small entrance at the side. It is often made of straight narrow leaves or grass and is a beautiful little home.

The Jumping Mice are harmless, inoffensive little things, and will often allow themselves to be taken in the hand and stroked without making any attempt to escape. Witmer Stone thinks they are "decidedly less intelligent than other Mice, trusting mainly to good luck and their gift at jumping to carry them through whatever dangers threaten. Apparently they never look before they leap, so that that which should be their safety often proves their ruin, as they are about as likely to spring directly into the clutches of a cat or other enemy as in an opposite direction; in this manner they are frequently drowned in milk-pans and tubs of water which a little ordinary caution would have avoided."

In the deep woods and near some stream is the locality in which to seek the *Woodland* or *Canadian Jumping Mouse*. It is more timorous than others and scuttles away from man with hops and bounds as fast as its legs will carry it. It is a large Mouse, having a total length of nine inches, its tail measuring nearly six inches. A noteworthy peculiarity of this species is the absence of premolar teeth. It is found through eastern Canada south to western Maryland. In habits it is similar to the Hudson Bay species.

THE FAMILY OF POCKET GOPHERS

(Geomyidæ)

THE Pocket Gophers are the only rodents to which the term "gopher" can be accurately applied; although it has been used erroneously for other burrowing animals of the Ground Squirrel tribe. The family *Geomyidae*, however, are our only true American Gophers, and are numerous enough and pestiferous enough to warrant all the profanity which has been levelled at "Gophers" indiscriminately.

This family includes a group of thick-set rodents which receive their distinctive name, "pocket," from the presence of large, fur-lined cheek pouches opening outside the mouth. These are used as genuine pockets for carrying things of quite as much value to the Gopher as the contents of their pockets are to small boys. The eyes and ears of these rodents are very small; the skull is broader than it is deep; the molar teeth have no roots; the fore feet are armed with long claws especially adapted for digging.

POCKET GOPHER

Geomys bursarius *(Shaw)*

Other Names.— Prairie Pocket Gopher, Red Pocket Gopher.

General Description.— A medium-sized burrowing rodent with small eyes and ears. Head broad and blunt; eyes very small; ears small; external cheek pouches fur-lined and opening on sides of face; incisor teeth large and prominent; body rather thick-set; tail short, thick and very scantily haired; legs short; claws long, especially so on the fore feet; pelage rather short but very soft; general color dull chestnut-brown, underparts paler. A burrowing animal little seen, but throwing out conspicuous mounds of earth.

Dental Formula.— Incisors, $\frac{1-1}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{1-1}{1-1}$; Molars, $\frac{3-3}{3-3}=20$.

Pelage.— ADULTS: Sexes identical. Seasonal variation occurring but not conspicuously noticeable. Upper parts dull chestnut-brown; underparts paler; bases of the hairs dark plumbeous; feet white; hair on basal portion of tail like back, terminal portion white. YOUNG: Similar to adults but colors weaker.

Measurements.— Total length, 11 inches; tail vertebrae, 3.2 inches; hind foot, 1.4 inches.

Range.— Upper Mississippi Valley, south of the Canadian boundary, from southeastern Missouri and southern Illinois eastward to Lake Michigan, westward to the Dakotas and Nebraska, southward to eastern Kansas.

Food.— Strictly vegetarian; roots and green vegetation.

Remarks.— The Pocket Gophers are a very large group, there being three genera in the United States with some 78 species and subspecies. All but one of these belong to two groups which might be called respectively the Eastern and the Western Pocket Gopher groups. The best distinguishing character is the possession of grooved incisors by the members of the Eastern Pocket Gopher group, and ungrooved by the Western. A wide range of variation is shown in size and color, as these animals reflect quite closely the effects of their habitat and environment.

RELATED SPECIES

Pocket Gopher.— *Geomys bursarius* (Shaw). Typical animal of the above description. Upper Mississippi Valley from Kansas, Missouri, Illinois, the Dakotas and Nebraska east to Lake Michigan.

Short-headed Pocket Gopher.— *Geomys breviceps breviceps* Baird. Smaller and darker. Lowlands of Mississippi Valley and Gulf Coast of southern Arkansas, Louisiana and Texas, northward nearly to Kansas, and west to 98th meridan.

Texas Pocket Gopher.— *Geomys texensis* Merriam. Small and white-bellied. Texas, central and southern parts.

Georgia Pocket Gopher.— *Geomys tuza tuza* (Ord). Tail longer and more naked; color above cinnamon brown. Pine barrens of Georgia.

Chestnut-faced Pocket Gopher.— *Cratogeomys castanops castanops* (Baird). Size medium; upper incisor with a single groove; yellowish-brown mixed with black above, beneath buffy. Great Plains from Colorado southward through eastern New Mexico and western Texas.

Columbia Pocket Gopher.— *Thomomys bulbivorus* (Richardson). Largest of the Pocket Gophers in the United States; total length, 14 inches; color dark; slaty-black. Lower Columbia River to coast of California.

California Pocket Gopher.— *Thomomys bottae bottae* (Eydoux and Gervais). Size medium; chestnut-brown above. Coast of California.

Golden Pocket Gopher.— *Thomomys aureus aureus* Allen. Size large; golden-yellow above. Utah.

Pallid Pocket Gopher.— *Thomomys perpallidus* (Merriam). Size medium; color very pale. Desert regions of southern California and Arizona.

Pygmy Pocket Gopher.— *Thomomys clusius clusius* Coues. Smallest species known; colors pale. Wyoming, Utah and Idaho.

Brown Pocket Gopher.— *Thomomys fuscus fuscus* (Merriam). Size small; chestnut-brown above. Found in Idaho.

Nevada Pocket Gopher.— *Thomomys nevadensis* Merriam. Large; two color phases, pale buff and plumbeous slate. Nevada.

Black Pocket Gopher.— *Thomomys niger* Merriam. Size medium; black. Western Oregon.

Canada Pocket Gopher.— *Thomomys talpoides talpoides* (Richardson). Size large; grayish black. Saskatchewan region south to upper Missouri.

If the farmers and fruit growers of the United States were polled on the question, "Which of the rodents, Field Mice, Rabbits, or Pocket Gophers, do you consider your worst pest?" the probability is that the unenviable distinction would be conferred on the Pocket Gopher. Rabbits work above-ground and protective measures can be taken against their depredations; Pocket Gophers operate under-ground, and, consequently, their ravages can seldom be forestalled.

The three genera of this family that occur in the United States are differentiated from one another by the kind of grooves which they have on their upper front teeth. In the largest genus, *Thomomys*, the upper incisors have each a very fine groove on the margin or none at all; in the genus *Geomys* the species have two distinct grooves; and in *Cratogeomys* there is one median furrow only. It is these sharp, powerful incisors which cause all the trouble for the farmer. Not only are they used in digging burrows or tunnels, which often admit surface water, leading to the washing of deep gullies, and sometimes cause breaks in canal banks and levees, but with them these "pesky little varmints" gnaw the roots of fruit and other trees, causing serious damage. Mr. David E. Lantz (Yearbook of U. S. Dept. of Agriculture, 1909), relates that in Heppner, Oregon, the owner of an orchard was absent from home but a week, and found on his return that Gophers had destroyed forty of his choice fruit trees. Originally these animals fed on the stems and roots of native plants; but no sooner had the settler introduced cultivated grasses and vegetables than the Gophers turned their attention to clover, alfalfa, and the succulent products of the gardens.

How swiftly the Gopher works when gnawing roots may be realized from observations of a tame animal made by Vernon Bailey. He says ("Pocket Gophers of the United States"): "The upper front tooth, or incisor, is used chiefly to anchor the animal to the root to be operated on, while the lower incisor does most of the work, playing rapidly back and forth like a steam drill until a piece is cut off and passed into the mouth. The cutting edges of the enamel plates of the molar teeth are the tools that reduce the food. The plates are arranged in such a way that thirty-eight distinct single cuts are made by the forward stroke of the jaw and twenty-eight by the backward stroke. In a tame Gopher it was ascertained by actual count that 200 complete strokes are made each minute. On this basis the number of cuts made each minute of the forward stroke would be 7600, and on the backward stroke 5600, making a grand total of 13,200 cuts a minute while the jaws are in active operation."

Pocket Gophers are strict vegetarians, subsisting mainly on roots, tubers, grass and the succulent parts of plants. They are not known to drink, and persons who have kept them in confinement have never succeeded in inducing them to do so. They derive the necessary water from the plants on which they feed. As their eyes are small and their vision limited, they must depend on touch, taste, and smell in selecting their food. In each cheek is an external hair-lined pouch in which the animals carry food to their storehouses. These pouches are never used for conveying dirt in burrowing, as has often been inaccurately stated. Enough food for a good meal can be collected and stowed away in these pouches in half a minute.

Bailey says the flesh of the Gopher is "tender and well flavored, and, were the animals large enough, they might be made a valuable adjunct to our meat supply." That many birds and beasts consider them dainty morsels is evidenced by the long list of their natural enemies, including hawks, owls, foxes, wild cats, and above all the weasel and the bull, or gopher, snake.

Pocket Gophers are not wholly nocturnal animals; they do not hibernate; only one litter a year is raised; and the number of young is from

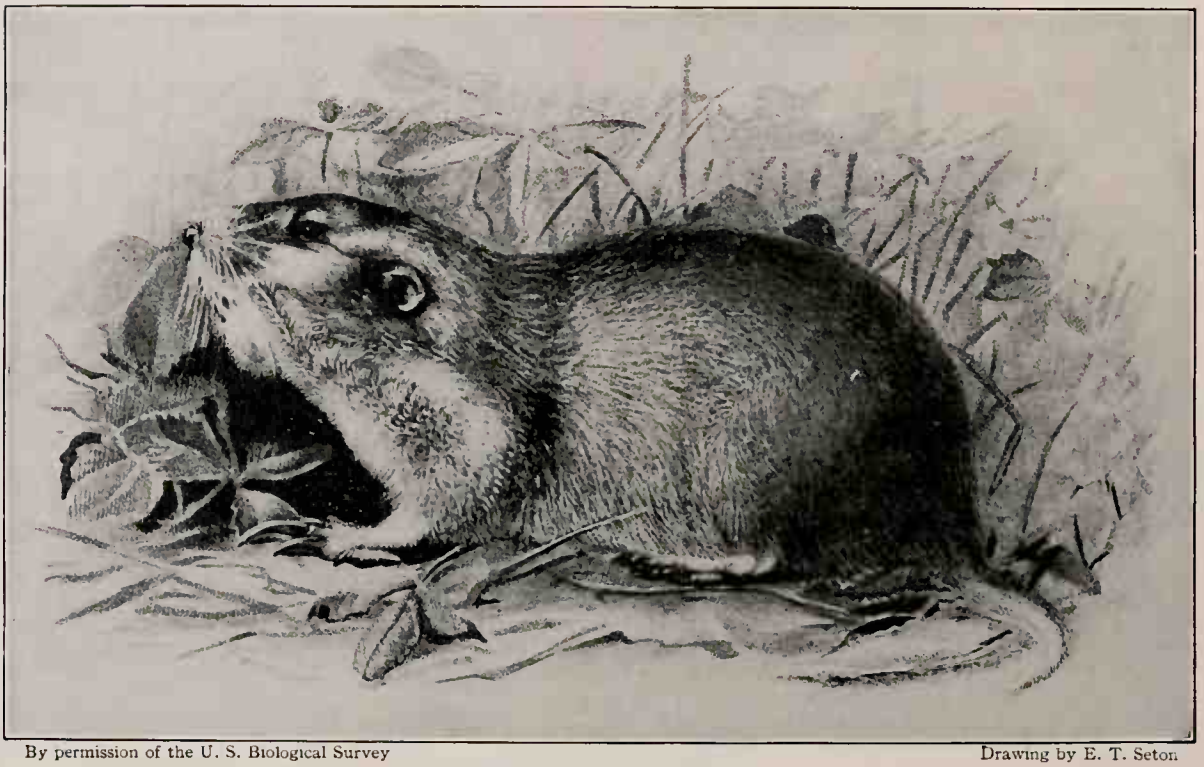
two to six. All Gophers are exceedingly pugnacious, and will fight even man or dog.

"Gopher burrows seem to have neither beginning nor end," writes Vernon Bailey. "They are extended and added to year after year, and in many cases those dug by a single animal would measure a mile or more, if straightened out. At the end of a year a Gopher may often be found within twenty rods of the point from which he started, but in traveling this distance he has paid no attention to the points of the compass. He follows a tender root for a few feet, then moves to one side, encounters a stone and makes a second turn. A layer of mellow soil entices him off in another direction, and so on through a thousand devious crooks and turns. At intervals openings are made through which to discharge the earth that makes the little piles called Gopher-hills."

Gophers have regular storehouses where roots and other foods are stored away, being carried in the peculiar pockets on each side of the face.

Dr. Goode describes their digging habits as follows: "They dig by grubbing with the nose and a rapid shovelling with the long curved fore-paws assisted by the pushing of the hind feet, which removes the earth from beneath the body and propels it back with great power a distance of eight or ten inches. When a small quantity of earth has accumulated in the rear of the miner, around he whirls with a vigorous flirt of the tail and, joining his fore-paws before his nose, he transmutes himself into a sort of wheelbarrow pushing the dirt before him to a convenient distance."

Merritt Cary, in "A Biological Survey of Colorado," says, "Ranchmen in the foothill valleys and mountain parks suffer considerable loss through the depredations of these animals, and every year a large acreage of alfalfa is killed by Gophers cutting the roots just beneath the surface of the ground. We discovered, three inches below the surface, a cavity in which a Gopher had a store of nearly fifty tiger-lily bulbs, evidently gathered the previous fall. The cavity was nearly full, and the bulbs were scattered through loose earth, which had been thoroughly worked over. A tunnel led directly from the cache to the flower-bed a rod or so distant. Near Golden the Gopher is said to



By permission of the U. S. Biological Survey — Drawing by E. T. Seton

PRAIRIE POCKET GOPHER

The specimen from which this drawing was made was secured in Manitoba. About two-thirds natural size

make itself a nuisance by burrowing in the banks of irrigation ditches and reservoirs, and this is probably true in other sections along the lower edge of its range. The numerous hills of earth and stones thrown up in hay meadows and grain fields dull the sickles of mowing and harvesting machines."

As an offset to the injury inflicted upon agricultural interests along the lower edge of its range, this animal is an important agent in the conservation of the forests and moisture in the higher mountains, where it is most abundant. The thorough and continual working and enriching which the soil receives through the activities of Gophers is highly beneficial to forest growth, and at the same time a large amount of moisture which would otherwise run off the mountain slopes is retained in the numerous burrows and underground tunnels which might properly be termed natural water traps.

On the higher open mountain slopes, particularly above timber-line, one often sees peculiar long serpentine ridges of earth, sometimes dry and hard packed, but more often partially disintegrated through the action of moisture. These are formed by Gophers during the winter when snow covers the ground to a considerable depth. The loose earth thrown out is packed into the ramifying tunnels which the animal has made through the snow on the surface of the ground.

With reference to breaks in levees caused by Gophers, it should be stated that means have been discovered whereby these expensive and often disastrous operations of the little burrowers can be arrested. Mr. Robert E. Jones writes: "When a burrowing Gopher strikes sand he stops. Nature has failed to provide him with the means for penetrating that kind of bank." Taking advantage of this fact, Mr. Jones has constructed a levee the outside casings of which are river bottom soil and the center is sand. This kind of levee has been brought into use on the Sacramento river, and has proved in every way effective.

OUT FOR A RAID

The Pocket Gopher is the terror of every farmer. It has a greedy appetite, and capacious pockets in its cheeks

The Prairie Pocket Gopher, the typical form described above, ranges the Mississippi valley from the Canadian border, south to southern Illinois, and from Lake Michigan to Nebraska. By reason of the fertility of the territory which it inhabits, Bailey considers this species of greater economic importance than all the other species combined. It is not rare to find one of its holes extending along a potato row, and every hill entered and entirely cleaned out. The damage they do is indeed enormous. Hickory saplings two inches through with their roots all

eaten off; two hundred apple trees destroyed in two years; thirty-five bushels of sweet potatoes taken from a cellar; two bushels of potatoes stored away in one burrow; fifty yards of hedge cut off — these are a few of the depredations cited by Bailey. His dog once dug out a nest containing two young Gophers. "They had no visible hair, their complexion was a beautifully translucent pinky white, their heads were round, and their little fat hands and fingers were touchingly babylike. Both eyes and ears were tightly sealed. They were helpless, and had the appearance of being born in a very rudimentary or undeveloped condition. The nest was a bed of soft grass and vegetable fibers on the bottom of an oval chamber in the burrow."

By permission of the U. S. Biological Survey

GEORGIA POCKET GOPHER

Nearly life-size. The enormously developed claws on the fore feet, adapted for digging, and the external cheek pouches are here well shown

THE PIKA FAMILY

(*Ochotonidæ*)

PIKAS occupy a family to themselves. They are rodents with forms somewhat between the Guinea-pigs and Rabbits, and at first glance might be mistaken for small brownish Rabbits. Unlike them, however, they are sluggish and do not run fast. They have also been found to have such highly specialized traits as to make it easier to classify them by giving them a separate family. These rodents, like the Hares, occupy a sub-order known as *Duplicidentata*, so called because of the presence of two pairs of incisor teeth in the upper jaw; one pair being smaller and set immediately behind the other.

The Pikas are found only in the higher mountains of northwestern North America. Their only relatives are to be found in Asia. Their closest relations in North America are with the Hares, to which they bear a superficial resemblance. They frequent mountainous regions of the west and northwest, especially along the timber line.

PIKA

Ochotona princeps (*Richardson*)

Other Names.— Cony, Little Chief Hare, Rock Rabbit, Tailless Hare, Whistling Hare.

General Description.— A small rodent lacking a tail and having somewhat the appearance of a diminutive rabbit. Head rather large and broad with conspicuous whiskers and large broad ears; body thick-set; no visible external tail; legs short; soles hairy; pelage thick, long, lax, and soft to the touch; toes, five on fore feet, four on hind feet; general color, brownish-gray or yellow.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{2-2}{2-2}$; Molars, $\frac{3-3}{3-3}=26$.

Pelage.— ADULTS: Sexes identical. Seasonal variation occurring but not especially conspicuous. Head and shoulders yellowish-brown, rest of upper parts grayish-black; sides yellowish-brown; underparts smoky-gray, tinged on chest and parts of belly with brown; ears bordered with white; feet white; soles dusky-brown. YOUNG: Grayer than adults.

Measurements.— Length, 7.5 inches; no external tail.

Range.— Rocky Mountains in British Columbia northward to south branch of Mackenzie River.

Food.— A variety of green plants, leaves of shrubs and grasses.

Remarks.— Twelve species of this peculiar rodent are recognized, the main distinctions being along the line of cranial and color variations.

RELATED SPECIES

Pika, or Cony.— *Ochotona princeps* (Richardson). Typical animal as described above. Rocky Mountains in British Columbia, northward to Mackenzie River.

Sierra Nevada Pika, or Slate-colored Pika.— *Ochotona schisticeps* (Merriam). Coloration from nose to nape slate-gray, rest of upper parts suffused with fulvous. Higher parts of the Sierra Nevada Mountains, California.

Collared Pika.— *Ochotona collaris* (Nelson). Ears thickly haired, iron-gray color on back and sides of neck; chin and throat white. Mountains from head of Tanana River to head of Bristol Bay, Alaska.

Colorado Pika.— *Ochotona saxatilis* Bangs. Pale yellowish-brown mixed with black on head and back. Colorado.

Little Pika.— *Ochotona minima* (Lord). Size small, color dark. Cascade Mountains, British Columbia.

Tawny Pika.— *Ochotona cuppes* Bangs. Colors dark, with much tawny on head, neck and underparts. Gold Range, British Columbia.

"The Conies are but a feeble folk, yet make they their houses in the rocks." If the writer of this passage in the Book of Proverbs had had in mind the Pikas, or Conies, of our western mountains, he could not have described them more accurately; for away up on the sides of high mountains, in the neighborhood of "slides," or masses of debris at the base of some cliff, these little animals have their homes. The lowest altitude at which a colony of them was found by Dr. C. H. Merriam, in Idaho, was 8600 feet.

The Pikas, of which twelve distinct American species are now recognized, constitute the sole genus of this family. They are curious little creatures whose appearance is something between that of a Guinea-pig and a Rabbit. They are seven or eight inches long, with small eyes, large and rounded ears, no external tail, hind limbs relatively shorter than those of the Hares, and "a rudimentary thumb with claw." The soles of their feet are padded with fur, enabling them to leap from rock to rock without losing their footing.

They are noisy little things, and "betray their presence to the intruder on their domains by sharp, squeaking, querulous ventriloquial notes or cries, deceptive as to distance and locality." They feed exclusively on vegetable matter, and lay up stores of grass and other herbage for the winter. They do not hibernate. The young are produced in the spring, about May, and there are generally four at a birth.

For so small and rare an animal, it has been greatly blessed with names. It is also called Chief Hare, Tailless Hare, Calling, or Whistling Hare, Rock Rabbit, and (from the fact that it never gets fat), by the miners of certain districts, "starved rat."

The Pika is found in the Rocky Mountains in British Columbia to the south branch of the Mackenzie River. In Idaho, in the Salmon River, and Saw Tooth Mountains, Dr. Merriam found it ranging from the Canadian zone to within a short distance of the summits of the highest peaks. It was encountered most abundantly in the neighborhood of timber line, between the altitudes of 10,000 and 11,000 feet. Pikas are nimble, active little bodies, "springing lightly from rock to rock, and running swiftly to and from their feeding grounds, often several hundred feet away." As stated above, they are vegetarians, their chief food-plant being the arctic-alpine *Geum rossii*. "This," says Dr. Merriam, "is their 'hay,' and they lay up large quantities of it for winter use, depositing it in little heaps in the spaces between the rocks. These storehouses average about the size of a bushel measure."

The Pikas are as industrious as the proverbial busy bee. In the early fall they may be seen for hours at a stretch carrying hay to their garners, running swiftly to the side of the rock slide, gathering a mouthful of leaves, and returning as quickly to deposit it in the accustomed place.

It is not known whether the Pika is night-loving as well as day-loving. Dr. Merriam once heard it at night, under exceptional circumstances. "One afternoon, about the first of September, Mr. Vernon Bailey and I carried our blankets up above timber line on the Salmon River Mountains and spent the night there. As darkness fell upon the mountains a storm set in. The wind blew a furious gale and rain began falling. Soon the rain changed to hail and sleet, and finally to snow. Much to our surprise, we heard the unmistakable cry of the Pikas at frequent intervals throughout the night. Whether they are usually nocturnal as well as diurnal, or whether the storm set them at work to move their storehouses to safer places, we have no means of knowing."

Photograph by J. M. Johnson

PIKA

A queer little animal living among the crevices of rocks; also called "Whistling Hare," or "Calling Hare," for its vocal attainments

The Pika's favorite retreats are crevices in the rocks, to which it swiftly runs when alarmed; but as it is fond of sunning itself, and its feeding grounds are frequently at some distance from home, eagles and hawks have many opportunities of making a feast from one of these careless little animals.

Merritt Cary, in "A Biological Survey of Colorado," says, "The habits of Conies are most interesting. As far as my observation goes, they live entirely in slide rock, usually on steep slopes, but near Silverton, Loring found their characteristic haystacks in the crevices of lumber and slab piles near an abandoned sawmill, while Mr. D. Costello, of Gardner, tells of one which took up its abode beneath the floor of a cabin in the mountains north of Crested Butte. The haystacks of these industrious little animals, comprising their winter food, are composed of many species of grasses and weeds, cut and gathered in summer, and allowed to dry among the rocks. Thistles are found in most of the stacks, and seem to be a favorite food. Well-worn runways lead from one stack to another and extend to neighboring rock slides. Conies are usually quite shy and would be seldom observed were it not for the odd, complaining notes which they utter continually when alarmed. The grayish color of the animal closely matches the dull-colored rocks in which it is found, and the notes often appear to come from a distant pile of rocks, when in reality the motionless animal is within a few feet; or again, the reverse may be true."

Photograph by Edward R. Warren

PIKA, OR CONY

A sure-footed little beast that is found in mountain regions, most abundantly about the timber line. It subsists on grass and other vegetation

THE FAMILY OF HARES AND RABBITS

(*Leporidæ*)

THERE is a great deal of popular confusion between the terms "hares" and "rabbits." To most people they mean the same thing; when as a matter of scientific fact they are two separate groups, each with its own well-defined species. This distinction is all the harder to make because the two animals have long been given interchangeable names. For example, our Jack Rabbits and Snowshoe Rabbits are not Rabbits, but Hares. On the other hand, the animals known as the Swamp Hare and the Pygmy Hare belong to the Rabbit group, as do the "Cottontails." In the case of the Jack Rabbits, the erroneous name has now been in use for more than half a century. As long ago as 1851, Audubon and Bachman, writing of a species found along the Mexican border, said: "This species is called the jackass rabbit in Texas, owing to the length of its ears." For the same reason, in certain parts of California they have been called "narrow-gauge mules" and "small mules." At this late day it is just as useless to attempt to change the name of the Jack Rabbit as it is to try to persuade the public to adopt the name Bison for the Buffalo; but it should be borne in mind that the Jack Rabbit is not a Rabbit, but a Hare.

There are certain well-defined characteristics by which Hares can be distinguished from Rabbits. The former never make burrows, but live in "forms" or nests of a kind (in which the young are brought forth), and are long-eared, long-legged, and swift-footed animals, the hind legs being considerably elongated. Rabbits proper have short ears, are short-legged, cannot maintain much speed for any great distance, and all of them make more or less use of burrows — frequently the abandoned homes of other animals — or of sheltering tree-roots, rocks, or similar places. Some of the species make their own burrows or tunnels. The young of Hares are born with a well-developed coat of hair and with their eyes open; baby Rabbits are born naked and with closed eyes.

Hares and Rabbits are among the best known of American animals. They range from northern Greenland to Patagonia and over the entire breadth of the two continents. Some of the species are to be found on the prairies, others make their homes in coverts and woods; some live in deserts where is little food and less water, others have their habitat in swamps and marshes; some roam the plains, others are to be found at altitudes of 14,000 feet or more above sea-level; and through all the gradations of temperature, from 50 degrees or more below zero to 140 degrees above, they seem to thrive and multiply. They reach their greatest abundance, however, in a stretch of country which Mr. E. W. Nelson, in his book "The Rabbits of North America," calls the "American Desert Plateau region." This region extends in a northerly and southerly direction from the northern United States to central Mexico, is about 2,000 miles in length, and has a maximum width of about 800 miles.

The coat of the Hare and the Rabbit corresponds, as to density and length, to the mildness or severity of the climate. In the Far North the Greenland Hare has a long, dense, woolly coat, while in southern Mexico the Tehuantepec Cottontail has a thin, short, and rather coarse pelage. The color of these animals also responds to climatic influences. Some of the species, which have two annual molts, are white in winter and dark in summer; but in Northern Greenland the Hare remains white throughout the year. The coat itself is made up of three sets of hairs: "(1) a fine, short, and dense underfur; (2) a longer, thinner, and coarser coat of hairs, the tips of which overlie and conceal the under-fur; and (3) a still longer, coarser, and more sparsely distributed set of hairs, the tips of which overlie the shorter middle coat."

The family *Leporidæ* is technically described as rodents of good size, robust body; hind limbs longer than the fore limbs; tail very short; wing-shaped postorbital processes; teeth more numerous than in any other family of rodents; incisors large, upper ones grooved; molars rootless; facial surface of maxilla perforated; clavicles imperfect. Specific differences between the Hares and the Rabbits have already been mentioned.

ARCTIC HARE

Lepus arcticus *Ross*

General Description.— A very large Hare turning white in winter, and living in Arctic America. Similar to the Varying Hare, but much larger and heavier. Head and ears large; body heavy; tail short; legs long; hind legs longer than fore legs; pelage long and thick, very soft to the touch; in summer white mixed with brown and gray; in winter pure white.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{3-3}{3-3}=28$.

Pelage.— Adults: Sexes identical. *Summer.* Everywhere white, mixed sparingly with brown and gray, the long hairs black pointed; face and ears, tawny-gray with black hairs on tips of ears; the white hairs are white throughout their entire length or white to the base. *Winter.* Pure white.

Measurements.— Total length, 26.5 inches; tail vertebrae, 2.5 inches; hind foot, 6 inches; ear, 4.7 inches. Weight, 10 to 12 pounds.

Range.— Baffin Land, extreme north coast of Hudson Bay, south through Ungava to Great Whale River on east shore of Hudson Bay, and Labrador north of Hamilton Inlet.

Food.— Green vegetation and bark of willows.

Remarks.— The Hares of the Arctic group are the largest of the North American Hares. Some of the Jack Rabbits, or Prairie Hares, measure almost as much as the Arctic Hares, but the latter are much heavier. Six species and subspecies belong to this group, all quite similar in general appearance, but varying a little in color, size and cranial characters.

Related Species

Arctic Hare.— *Lepus arcticus arcticus* Ross. Typical animal as described above. Baffin Land, northern and northeastern Hudson Bay region, Ungava and Labrador.

Newfoundland Hare.— *Lepus arcticus bangsii* Rhoads. Grizzled gray in summer. Newfoundland and adjacent parts of Labrador.

Greenland Hare.— *Lepus groenlandicus* Rhoads. White suffused with tawny in summer. Northern Greenland and Ellesmere Land.

Alaska Arctic Hare.— *Lepus othus* Merriam. Size largest of the Arctic Hares. In winter everywhere white except ears which are black tipped. Tundras of northern and northwestern Alaska.

The Arctic Hares live in the frozen wastes of the Far North. Throughout most of their range they summer north of the tree limit, but in winter sometimes penetrate a hundred miles or more into the northern border of the timber. All the species have two annual molts, and, save for the tips of the ears, are pure white in winter. The summer pelage is usually gray or brown. The Arctic Hare swims freely across the small streams which in spring traverse the Arctic barrens in all directions. This handsome animal is the main diet of many larger beasts of prey; and has often saved the life of man himself. The Indians and trappers in the Far North have for years depended on it for food on many a forced march. At the same time it is not always easy to capture. Its white coat enables it to rest serenely in its "form," often unseen by the searching eye of owl or gyrfalcon, while its speed enables it to show a clean pair of heels to its pursuers in many a chase by the Blue Fox, Wolverene, Lynx or Gray Wolf. It feeds mainly on lichens and stoneworts and the twigs of alpine plants.

The Hudson Bay, or Hoary, Hare, a still smaller species, is found in the barren grounds from Fort Churchill northwards, and is distinguishable from the type mainly by its gray summer pelage. Mr. Edward A. Preble states that "in winter they migrate to a slight extent, reaching the neighborhood of York Factory and perhaps farther." Describing his search for specimens of this Hare, he says: "I had walked several miles before my attention was attracted by what at first appeared to be a boulder on which a small restless bird was perched. A second glance showed that the object was an Arctic Hare, whose ears, twitching slightly, completed the resemblance that had deceived me. Another was afterward started from beneath a dwarfed

willow near by. Both were secured, and proved to be males, evidently young of the year, but full grown."

The *Greenland Hare* ranges over the northwestern coasts of Greenland and Ellesmere Land, its distribution coinciding largely with that of the northern Musk-ox. It is larger than the Arctic Hare, and its summer pelage is white suffused with light tawny. It is remarkable for its excessively heavy fur, the thickness of which "gives the coat a woolly or fleece-like effect. The young (which are about one-third grown in July) have an odd resemblance to very young lambs, owing to their dingy-whitish woolly coats. This Hare has very stout claws and extremely long, outreaching incisors — characters not approached by any of its known relatives.

The *Alaska Hare*, a habitant of the tundras of northern and northwestern Alaska, except the peninsula and the Bristol Bay section, is the largest of all the American Arctic Hares. It has very large feet, and is of a darker brown in summer; but in winter becomes pure white except for the black tips on its ears.

VARYING HARE

Lepus americanus *Erxleben*

Other Names.— American Hare, Snowshoe Hare, White Hare (or "Rabbit").

General Description.—A good-sized rodent with large ears, long legs and very short tail. Head broad; nose blunt and rounded; eyes large; ears exceedingly large, thickly covered with short hairs; body of good size; tail very short; legs long, hind legs longer than fore legs with much larger feet; soles of feet exceedingly hairy; toes, five in number on fore feet, four on hind feet; pelage of two coats, a shorter underfur and a longer outer coat. Generally an animal of timid, nervous temperament.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{3-3}{3-3}$=28.

Pelage.— Adults: Sexes identical. *Summer.* Above, reddish or cinnamon-brown darkest along the back; beneath, white; ears tipped with black posteriorly, the black extending down toward the margin; anterior edge of ear white; tail above sooty-brown, beneath grayish; throat except extreme upper part of chin, brownish-buff. *Winter.* White everywhere, except tips of ears which are black, the hairs having a narrow middle band of reddish-brown. Young: Similar to adults but much grayer.

Measurements.— Total length, 19 inches; tail vertebrae, about 1.5 inch; hind foot, 5.5 inches. Weight about 3 pounds.

Range.— From southern end of Hudson Bay to southern Keewatin, Mackenzie, most of Saskatchewan, Manitoba east through northern Ontario, northern Quebec through Ungava and Labrador, south into United States to Michigan north of Saginaw, and west to Wyoming.

Food.— Almost any green vegetation or bark of trees.

Remarks.— The Varying Hare is representative of a group of 12 species and subspecies, also commonly known as Snowshoe Hares because of the large track they make in the snow. These animals are true Hares and are closely related to the Arctic Hares and to the large Jack "Rabbits" or Plains Hares. In classifying this small group of Hares considerable emphasis has been laid upon cranial structures, but correlated with these we find certain variations in size and color as well.

Related Species

Varying Hare.— *Lepus americanus americanus* Erxleben. Typical animal as described above. Most of eastern half of Canada, west to Saskatchewan, and south to Michigan and Wyoming.

Minnesota Varying Hare.— *Lepus americanus phaeonotus* Allen. Smaller, paler and buffier than the typical Varying Hare. Northern Michigan, Wisconsin, Minnesota and into western Ontario and southern Manitoba.

Virginia Varying Hare.— *Lepus americanus virginianus* (Harlan). Largest and most richly colored of the Varying Hares. In summer rusty-brown above. Mountains of West Virginia and Virginia, north through eastern United States to Maine and extreme southern Ontario.

Nova Scotia Varying Hare.— *Lepus americanus struthopus* Bangs. Hind foot shorter; color darker than the typical Varying Hare. Nova Scotia, New Brunswick, Quebec and Newfoundland south to Maine.

MacFarlane's Varying Hare.— *Lepus americanus macfarlani* Merriam. Larger than the typical form with longer ears; dusky-gray above. Wooded parts of Alaska, base of Alaskan Peninsula, Yukon Territory, western Mackenzie, northern British Columbia and northwestern Alberta.

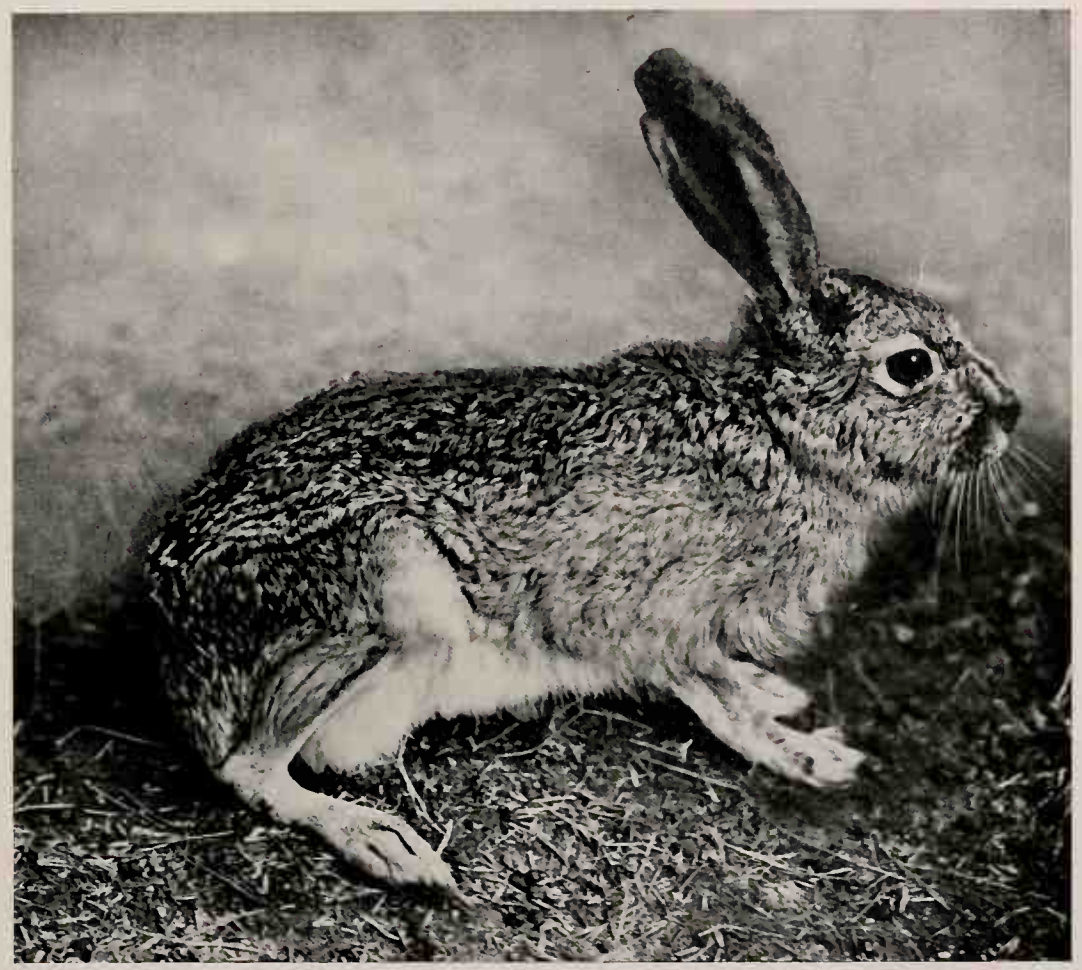
Baird's Varying Hare.— *Lepus bairdii bairdii* (Hayden). Size large; pale grayish-brown mixed with black. Higher parts of Rocky Mountains from Idaho, Montana, eastern Washington and Oregon, south to central New Mexico, and north to southern Alberta and British Columbia.

Washington Varying Hare.— *Lepus washingtonii washingtonii* Baird. Small; a dark reddish form with little or no white; does not turn white in winter. Washington northward to Fraser River, British Columbia; and from the west slope of the Cascade Mountains to the sea.

"Varying Hare, the books call him; and he takes his changeable color-notions, perhaps, from the swamps, wearing in summer the brown of their slow water — brown with just a hint of blue in it — but remembering always the waxy white of the blossom-heads above him. Half alien he seems to these months of heat, and he is seen then — if seen at all — as a typical "limping hare" of the poets, lean and listless, with small suggestion of his winter vigor. Yet he winter." Thus writes Edward A. Briggs, in *Field and Stream,* who continues:

"If the first frost spells joy to other fur-bearers, the big hare finds in it a tang of ecstasy. Essentially a northern breed, his kind range even to the Arctic circle; the Canadian timber swarms with him; generations of New England boyhood have snared him in his paths.

"When the brief October flare has died down to iron and ashen November, he works his mir-



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PRAIRIE HARE

Known also as the White-tailed Jack "Rabbit." A very large Hare with extremely long, mule-shaped ears

plies a sure activity, in the green cover, harboring his queer, big-headed young in secret surface nests, and cutting clean paths on which he and they may reach with ease the choicest feeding-grounds far up the barrens, or flee back to the quick safety of the swamps. Forking and crossing and fading into nothingness, these paths are the surest clue to his presence, summer and acle, whereby to pay due homage to the North. The snows are just ahead; and was he not born beneath a snowy rhododendron bloom? It is a true miracle, not complete in an hour or a day. First, the merest silvering on his brown sides; then a growing pallor that smothers him in a smoky drab, but leaving transient blots and splashes of brown along his spine and especially

on his forehead and upper cheeks, for all the world like the spotted circus ponies of one's childhood; last of all, ermine-white. Not the trimness of the winter Weasel, however, nor the smooth ivory of your pink-eyed Easter bunny, but a loose-brown fluffiness, careless yet beautiful, and a sure duplicate of light-piled snowflakes that have zigzagged down through the brush. With their first fall he matched the twig-pierced blanket laid upon the thicket floors; by mid-December he moves across the drifts intangible as a flying cloud-shadow. Right in the dazzling open he may pause, and the gun that flew up to cover him is lowered, the eye peering uncertainly, to find him gone — or sitting there still, white of whiteness.

"Close at hand he reveals one unexpected lingering of color; his alert, expressive ears — rounded and not too long, a true woods ear — are tipped and edged with black that never alters. The reason is baffling, but once discovered it is a very triumph of mimicry. For as he crouches beneath a shrub his ears are folded along his neck and throw a shadowing color there, just as every rounded snow-hummock is somewhere crossed with shadow from the twigs above.

"At times his pelage plays him false. The harlequin half-way coat cannot but advertise his movements, though at rest it is obscure enough; and now and then winter grows faint-hearted and leaves him white — prominent in a world of grays and browns. But he takes his troubles philosophically, sticking to cover with closer persistence, and biding the near time when he may drift invisible again across the snows."

The Varying Hare changes his coat twice a year, in spring and autumn,— hence his name. He is often called "Snowshoe Rabbit," because the elongated track he makes in the snow looks like a diminutive snowshoe track. The popular story that he changes his coat in a single night or with the first snowfall is untrue. The change is gradual and accomplished by shedding and new growth. There are two Hares in this group, the Washington Varying Hare and the Oregon Snowshoe "Rabbit," whose coats do not turn white in winter. It is worth noting that most of the southern forms in the summer coat have the upper part of the hind feet brown similar to the body, whereas the northern and the high mountain Hares have the tops of the hind feet white.

The Varying Hares occupy a greater stretch of territory than any other group, ranging from the Atlantic coast to the Pacific, and to the shore of Behring Sea in Alaska; and as far south as Virginia in the East and New Mexico in the West.

Mr. Edward A. Preble found them abundant in the Athabaska region of Canada. "While descending the Athabaska and Slave rivers we saw large numbers of Varying Hares," he states. "In many places along the banks the dense thickets of willows and other shrubs had been eaten almost down to the ground. On the Smith Portage road their ravages are especially noticeable, the young Banksian pines being here their principal food. The many evidences of winter snaring, and the thousands of white 'rabbit' skins which littered the neighborhood of an occasional deserted Indian camp, showed that this locality had been a favorite resort for both 'rabbits' and Indians during the preceding winter." In this district, each Indian, and some of the white inhabitants, maintained what was known as a "rabbit track." This was a trail extending for several miles with snares set at frequent intervals. "A pole to which the noose is attached is balanced over a convenient limb and tips up when the snare is released, suspending the animal in midair. This insures a speedy death and places the quarry out of reach of dogs and other predatory quadrupeds. They freeze in the snares and are kept for weeks and months in this state without deterioration, and figure extensively on the winter bill-of-fare at the northern trading posts."

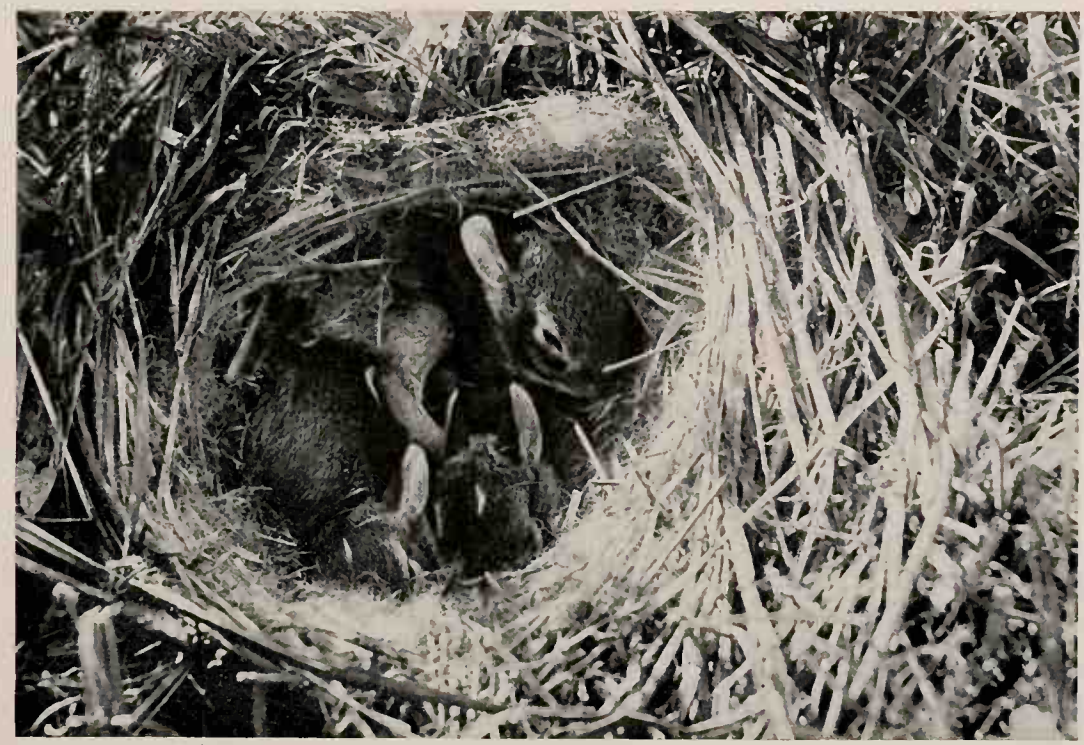
Varying Hares are a favorite prey of the bald and golden eagles, several of the hawks, and the snowy, great-horned, and some other owls, while among their four-footed foes must be reckoned the lynx, wolf, fox, sable, mink, weasel and ermine, besides domestic dogs and cats. Indians use the skins for robes, mittens and caps. The Dogribs lure the animals within rifle range by making a kind of rasping squeak. Preble "easily learned to imitate the sound, and soon became a proficient rabbit caller. The method is successful only during the breeding season. Adults of both sexes are attracted by the sound, but the young seldom respond to it." This is a curious analogy to Moose-calling.

These Hares are subject to several diseases; and epidemics, recurring about every five or six years, often reduce their numbers to the verge of extermination. Major A. E. Snyder, writing from the Yukon, of the results of one such epidemic, says: "The disease has evidently spent itself and only the healthy rabbits are left. In a journey recently of twenty days' duration, I saw only two; in other words, where there were

thousands two years ago, they are in ones and twos now."

The Varying Hare, however, is gifted with numerous families (like others of its tribe) and soon renews the population. It has three litters during the summer, with two or three young in each litter. Mr. Preble noted that, in spite of disease, of unlimited snaring by the Indians, and of the attacks of their animal foes, when spring arrived the Hares were found to be "fairly abundant."

that season is easy enough, but to avoid the numerous enemies that beset them must be much more difficult, and I doubt if one out of a dozen ever attains its growth." They feed voraciously upon the bark of young trees, twigs, buds, and shoots, reaching up to some distance on their long hind legs; but it never seems to occur to them to carry any of it away to the cover of the evergreens where they sleep, and in consequence they are obliged to be abroad in all kinds of weather or go hungry until the storm is over. They



Photograph by J. H. Field

YOUNG WILD RABBITS

An unusual and interesting picture secured by a keen-eyed field observer. It shows a nest of three Rabbits only eight days old

The *Virginia Varying Hare* is the largest, brightest, and most richly colored form. It is about twenty inches long. Its summer coat is of a rusty brown with a wash of black heaviest on the back; under parts white. In winter, in the southern parts of its range, the pelage is sometimes partially brown, instead of pure white as in other forms. Of the feeding habits of this Hare, Mr. Witmer Stone says: "As soon as they are able to take care of themselves, or even before, judging from outward appearances, the young ones are turned adrift to support themselves as best they may. The matter of finding food at

usually pass the day crouching motionless, half asleep in the shadow, though not averse to sunning themselves at midday, especially during the latter part of the winter. Toward sunset they start out in search of food and are back in their forms again soon after sunrise, but whether they spend the entire night in feeding, or only the hours of twilight, is not easy to determine.

This Hare is a habitant of the mountains of West Virginia and Virginia, and is found as far north as Ontario. In the Adirondacks it has been found at an altitude of 4000 feet. In many districts the northern extension of the range of

the Cottontails is restricting the area occupied by Varying Hares; the latter have almost disappeared from the State of New Jersey.

Baird's Hare is interesting as being one of the largest of the species, and also the most southern in its range. It lives in the higher parts of the Rocky Mountains from Great Slave Lake south to central New Mexico. In northern New Mexico and Colorado it has been seen at an altitude of 11,000 feet. It is of nearly the same size as the Northern Varying Hare, but its ears and hind feet are longer. Also it is more dusky in summer, the feet are usually pure white, and the deep reddish cinnamon of the head contrasts strongly with the dusky color of the body. In winter the coat is entirely white, except for a narrow dusky border to the ear tips, which is noted in other species.

WHITE-TAILED JACK "RABBIT"

Lepus campestris *Bachman*

Other Names.— Prairie Hare, Plains Hare.

General Description.— A very large Hare with long robust hind legs, and a conspicuous white tail. Head fairly large and broad; eyes large; ears very large and shaped somewhat like those of a mule; body robust; tail fairly long for a Hare, broad and bushy; hind legs decidedly longer than fore legs; general color gray to grayish-brown above, pure white below; pelage quite long and soft. An animal of the open fields or prairies.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{3-3}{3-3}=28$.

Pelage.—Adults: Sexes identical. *Summer.* Entire upper parts, sides of legs, throat and band across chest yellowish-gray mixed with dark-brown; sides clearer gray; nape smoky white; undersurface of head and belly white; legs gray, tinged with rusty; below clear white; fringe and border of ears white; tip of ear jet-black inside and out. *Winter.* Pure white except for black marks on tips of ears. Young: Similar to adults but more uniform slaty-gray.

Measurements.— Total length, 24 inches; tail vertebrae, 4 inches; hind feet, 6 inches. Weight 7 pounds.

Range.— Great Plains of Alberta, Saskatchewan and Manitoba south to Montana, Wyoming, the Dakotas, Minnesota, Iowa, Nebraska, northern half of Kansas, Colorado east of Rockies, and northern New Mexico.

Food.— A variety of green vegetation, bark and twigs.

Remarks.— There are only three subspecies of the one species in this group, known as the White-tailed Jack "Rabbit" group. Although frequently found in regions with other Jack "Rabbits" belonging to the Black-tailed Group, these animals may be distinguished at a glance not only by their larger size and conspicuous white tail, but also by certain peculiarities of habit.

Related Subspecies

White-tailed Jack "Rabbit."— *Lepus campestris campestris* Bachman. Typical animal as described above. Great Plains region from Saskatchewan and Manitoba south, east of the Rocky Mountains, to northern New Mexico, and east to Minnesota and Iowa.

Townsend White-tailed Jack "Rabbit."— *Lepus campestris townsendii* (Bachman). Smaller, paler, and with less black on the ears. Great Basin region from east slopes of Cascade range to Rocky Mountains in eastern Washington, Oregon and California; north to British Columbia and east to Idaho, southwestern Wyoming, Utah and Colorado.

Sierra White-tailed Jack "Rabbit."— *Lepus campestris sierrae* Merriam. Largest of the three subspecies, pale and with much black on ears. High slopes of Sierra Nevada of California.

Although called the Prairie Hare, this species is found also on mountain slopes at altitudes of 10,000 to 12,000 feet on both the Sierra Nevada and the Rocky Mountains. Its range extends from middle Kansas northward to the plains of the Saskatchewan, Canada. It is a large Hare, its total length being about two feet. It has a long and silky fur, exactly the color of the sand and the dead leaves under the bushes where it makes its forms. In these forms the Prairie Hare rests for hours at a stretch apparently indifferent to danger, but really always on the alert. Dr. Coues doubts whether it ever stands erect with its forepaws off the ground. When squatting on its haunches, in a listening attitude, one fore foot is advanced a little before the other, and the ears point in opposite directions. It is an exceedingly agile animal, and its mode of

progression is a series of leaps and bounds. It starts off with a great bound, and, says Dr. Coues, "the instant it touches the ground it is up again, with a peculiar springy jerk, more like the rebounding of an elastic ball than the result of muscular exertion. With a succession of these high jerky leaps the animal makes off, generally in a straight course; there is nothing of the dodging or scuttling about that marks the running of the smaller Rabbits."

These Jack "Rabbits" do not occur in such numbers as the Black-tailed species. Dr. Coues says it is not in the least gregarious. "I have never seen nor heard of several together," he states, "and indeed it is rare to find even two together, at any season whatever. It is one of the most solitary animals with which I have become acquainted. If it has any preference however, it is for 'weedy' tracts, of which the sage-brush regions furnish the best examples;

Photograph by S. Brunner

JACK "RABBIT"

In its winter coat — pure white except for tips of ears. While really a Hare, this rodent is universally called a "Rabbit"

Opinions differ as to the frequency with which the Prairie Hare breeds; but Dr. Palmer states that the evidence available "not only fails to substantiate the view that Jack Rabbits breed every six weeks in the year, but there is every reason to believe that each species has a regular breeding season and a definite period of rest." The young, usually four, occasionally six, are born in June or July.

there it finds shelter, which the low, crisp grass of rolling prairie does not afford, and doubtless also secures a greater variety of food."

Inasmuch, however, as a commission house in Saint Paul, Minn., handled 12,000 Jack "Rabbit" skins from North and South Dakota, where the White-tailed is the only species, it is evident that they must be fairly abundant in some districts.

WHITE-SIDED JACK "RABBIT"

Lepus alleni *Mearns*

Other Names.— Allen's Jack "Rabbit," Antelope Jack "Rabbit."

General Description.— A very large Hare with extremely large ears and hind legs, white mottled sides, black tail. Head large and broad; ears enormous, well-clothed with short hair; body large; tail short, marked with black; pelage quite long and thick. A desert animal.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{3-3}{3-3}=28$.

Pelage.— ADULTS: Sexes identical. Seasonal variation not especially conspicuous. Above yellowish-brown mixed with black; nape of neck fulvous; sides, hips, rump and outside of legs white mixed with black, giving a salt and pepper effect; a fulvous band across chest, rest of underparts white; head, pale yellowish-gray; feet above white; tail above like back but with a line of plumbeous-black extending onto it from the rump, beneath white; ears whitish with white fringe. YOUNG: Very similar to adults.

Measurements.— Total length, 26 inches; tail vertebrae, 2.5 inches; hind feet, 5.5 inches; ear from notch, 6.2 inches.

Range.— Desert plains of southern Arizona south into Mexico.

Food.— Desert vegetation.

Remarks.— Allen's Jack "Rabbit" typifies one of the most highly specialized groups of North American Hares. This group contains some 12 species and subspecies to be found north of the Rio Grande, most of which have the characteristic black tail, and for this reason are known as Black-tailed Jack "Rabbits." None of this group becomes white in winter, and all are desert or semi-arid plains types. Classification of this group is based to a considerable extent on cranial characters which are correlated often with noticeable variations in color and in proportions of different parts.

RELATED SPECIES AND SUBSPECIES

Allen's Jack "Rabbit."— *Lepus alleni alleni* Mearns. Typical animal of the above description. Desert plains from southern Arizona south into Mexico.

Sinaloa Jack "Rabbit."— *Lepus alleni palitans.* Bangs. Skull largest of American Hares; ears long; tail less black above; sides of head and back bright cream to pinkish-buff. Pacific Coast to Mexico.

Gaillard's Jack "Rabbit."— *Lepus gaillardi gaillardi* Mearns. Ears enormous; above pale ochraceous-cinnamon mixed with black; tail above, black with many white-tipped hairs. Grassy plains of southwestern New Mexico southward.

Also see Black-tailed group which follows.

The White-sided Jack "Rabbits" are perhaps the most striking and the handsomest of all the North American Hares. They differ from others in having the sides mottled white, the hindquarters being usually gray, and no black patch on the back of the ear-tips. In Nelson's opinion, "it is safe to assume that the white on the sides serves the same purpose in all these species. By means of muscles the skin of either side can be drawn over the back at will. In this manner the buffy or brown dorsal area is shifted more or less completely to one side and the white on the opposite side is drawn nearly or quite to the median line. This habit has been observed when the Hares were standing, or moving along at moderate speed, usually after they had been driven from their forms. This enlargement of the white area is always on the side turned toward the chance intruder, and accordingly alternates from side to side as the animals slowly zigzag away. In the bright sunlight the snowy white side flashes brilliantly, attracting attention from afar, and affording a fine example of directive coloration."

This group of Jack Rabbits ranges from the southern portion of the State of Arizona and the extreme south of New Mexico to beyond the isthmus of Tehuantepec. It may in fact be considered a Mexican group. Individuals are found at sea level and at various altitudes up to about 8500 feet. They live commonly on open plains.

Allen's Jack "Rabbit" is one of the largest and handsomest of the White-sided group. It is about twenty-six inches in length, has enormous ears, long and slender legs, and, with the exception of the Sinaloa Jack Rabbit, the largest skull of any American Hare. The strikingly bright color of its coat completely differentiates it from the other species. It has been noticed that the richness of coloration increases in intensity to the southward, while "the pale typical form is limited mainly to the hot plains of southern Arizona."

Concerning its habits, Mr. W. W. Price says: "This splendid Hare is abundant about Tucson and in lower portions of the desert belt. It is somewhat shy, and hard to secure, except with a rifle. One rarely comes upon it suddenly. It has a slow, apparently awkward gait, but its leaps are long, and it gets over the ground with surprising rapidity."

LYING LOW

A familiar attitude of the Jack "Rabbit," when trying to escape observation

The subspecies known as the *Sinaloa Jack "Rabbit"* is even handsomer than Allen's Jack "Rabbit," the sides of the head and the back being of a much richer and brighter cream-buff or pinkish-buff; the tail has less black on the upper part; and the skull is larger than that of any other American Hare. It ranges along the Pacific Coast from Sonora to northern Tepic, the most intensely colored specimens coming from Alamos, southern Sonora.

The *Gaillard Jack "Rabbit"* is one of the rarest. In size and general appearance it resembles the type species. It is found over a comparatively limited area, occurring mainly along the eastern basal slopes of the Sierra Madre in Chihuahua, extending thence over the immediately adjacent part of the grassy plains and westward into the open pine forest of the Sierra Madre. In this forest it is rare up to 7000 feet, and the few found there were probably merely stray summer residents.

BLACK-TAILED JACK "RABBIT"

Lepus californicus *Gray*

General Description.— A large Hare with ears a trifle smaller than the White-sided Hare. Head large; body heavy; legs very long; pelage long and thick. A desert animal.

Dental Formula.— Same as White-sided Hare.

Pelage.— Adults: Sexes identical. Seasonal variation not marked. Above, yellowish-brown mixed with black; sides, rump and thighs tinged with cinnamon; tail above black, the black extending onto rump; beneath pale buff.

Measurements.— Total length, 28 inches; tail vertebrae, 2.6 inches.

Range.— The California deserts.

Food.— Desert vegetation.

Remarks.— Classed with the group typified by Allen's Jack "Rabbit," which are characterized both by the white side and black tail. All are nearly related, but for ease of reference the other members of the Black-tailed group are here considered together.

Related Species

California Black-tailed Jack "Rabbit."— *Lepus californicus californicus* Gray. Typical animal described above. Desert plains of California.

Columbia Black-tailed Jack "Rabbit."— *Lepus californicus wallawalla* (Merriam). Above gray mixed with black; sides clearer gray; tail above black. Northeastern California, northwestern Nevada, and north through eastern Oregon and Washington.

Great Plains Black-tailed Jack "Rabbit."— *Lepus californicus melanotis* (Mearns). General color above, bright fulvous with no gray or ashy; body with blotchings of black; ears mixed brown and black anteriorly; tail above black. Great Plains from Texas and New Mexico north to Dakota and Nebraska west to the Rockies.

Texas Black-tailed Jack "Rabbit."— *Lepus californicus merriami* (Mearns). Ears quite large; color above, grayish mixed with black; underpart white; nape of neck black; tail above black. Southern Texas.

In several respects this is the most important group of all our Hares. The territory occupied by its members is simply enormous; the losses resulting from its depredations on crops, garden truck, and trees and shrubs aggregate thousands of dollars annually, and constitute one of the most serious among the many problems which the American farmer has to grapple with; and the large traffic in the animal, both as a source of food and for its fur, gives it considerable economic prominence.

Our Black-tailed Jack is an ubiquitous animal. From southeastern Washington down to the Valley of Mexico, from Kansas and Texas to the Pacific Coast, and even on the remote islands of Lower California, he is to be found in pos-

session. The widest ranges of temperature do not bother him; he is equally comfortable on the scorching plains and deserts of the West, and on Mexican Mountains 8000 feet or more above the level of the sea. Scarcity of food causes him no anxiety; for he can thrive where many another animal would starve. Even his enemies, and they are many, can gain only a temporary advantage over him; for in spite of the attacks of beasts and birds of prey, of the pursuits of sportsmen in search of game, and under the juniper, or in the greasewood, squatting perfectly motionless with their long ears laid flat upon their backs, "their color harmonizing so well with their surroundings that they are rarely seen until they start with a great bound and gallop swiftly away." Dr. T. S. Palmer says that certain shrubs in the West "are commonly known as 'rabbit brush' because they grow in dense thickets in which 'rabbits' are fond of hiding." Where there are no bushes, the animals seek the shade of any object to

Photograph by H. E. Anthony

COLUMBIA BLACK-TAILED JACK "RABBIT"

The protective coloring of this animal among the sage and mesquite is well shown

of hunters in search of State bounties for his destruction as vermin, not to mention epidemics carrying off thousands of his race, the Black-tailed Jack "Rabbit" continues to survive and flourish.

Unlike the Cottontails, the Jack "Rabbits" do not live in burrows. They make their forms or nests in patches of grass, under the low branches of trees, in tufts of shrubs, or any similar place where they can find protection from the weather and bring forth their young. In the Little Colorado Desert, for instance, they may be found in the intense heat of the day shelter them from the burning sun; and on the Southern Pacific Railroad, these Hares may sometimes be seen "crouching in the shadow of the telegraph poles, evidently alarmed by the train, but uncertain whether or not to forsake their shady spots and seek safety in flight." It may be noted here that Jack "Rabbits" do not turn up the tail like Cottontails, so that the color of the upper surface, whether white or black, can easily be determined even at a distance.

There are very few positive data available as to the breeding habits of Jack "Rabbits," but Dr. Palmer, from the examination of very

young animals, has been able to arrive at certain information. He says: "The length of the breeding season in southern regions indicates that several litters are born each year; but in the northern United States the number is probably not more than two, or, at the most, three." The earliest date of birth is about the beginning of January (in desert region of southern California and southern Texas); the latest, September (Arizona, Texas and Chihuahua). Most of the young seemed to be born in April, May and June. The number of young in a litter were: California Jack "Rabbit," four; Texas Jack "Rabbit," one to six; Great Plains Jack "Rabbit," one. It should, of course, be remembered that these figures were based on comparatively few specimens.

To dwellers in the East, the numbers of these animals seem incredible. Mr. Alvah H. Eaton, speaking of their ravages in Fresno County, California, says: "It was no uncommon thing to start 1000 rabbits out of a patch of weeds, and in one patch about a quarter of a mile long there were at least 5000. From 20,000 to 25,000 of these animals are sometimes destroyed in a single battue or drive." When wild feed gets scarce, they invade the cultivated areas, if there are any near. All growing grain crops receive especial attention from them; apple and plum trees, raspberry and grape vines, melons, cabbage and carrots — all come alike to them. In Texas, Mr. W. J. Crowley reports "that they cause considerable injury to grain, and in fields of wheat, oats and cotton often cut paths twelve inches wide, and 300 or 400 yards in length, and destroy patches as large as an ordinary sized room." Whitewashing the bark of peach trees does no good, as "the rabbits take the whitewash and the bark together." Even timber claims planted in black locust, "large and old enough to 'prove up' on have been destroyed by them."

The *California Black-tailed Jack "Rabbit"* is found in the California humid coast belt from Cape Mendocino south to Gaviota Pass, and inland through the north of San Joaquin Valley, Sacramento Valley, and north to Oregon. It has often been confused with the Texan species, but is browner and darker above, and its underparts are tan color or buff, instead of white, as in the Texan Jack "Rabbit." It is most abundant on the chaparral-covered slopes of the western foothills of the Sierra Nevada. Some idea of the numbers of this Jack "Rabbit" may be gathered from the fact that Modoc County, California, alone, in three consecutive months, paid in bounties (of three cents a head) $876.77 for 27,559 scalps.

Coursing this Jack "Rabbit" with greyhounds is a favorite sport in California and elsewhere. Mr. T. S. Van Dyke writes: "A dash after the Hare on a good horse and behind good dogs is one of the most charming of outings. The horse enjoys the sport as well as the dogs do. The ground flies beneath you, the surrounding mountains swim in a haze, the whole amphitheater seems to turn around while you are standing still. Vainly the Hare twists and sends the dogs spinning ahead in confusion, while he scuds away on his new tack without the loss of an instant, so far as you can see. All ordinary dogs fall out of the race. But if the greyhounds are good and the brush not too near, the Hare's doubling only postpones his end, however untiring his foot, or frequent his twists. Vainly he lays his ears flatter upon his neck and lets out another link of his reserved speed. Before he has made many turns he is caught — perhaps in mid-air — and the dogs and Hare go rolling over in a heap together."

The *Texas Jack "Rabbit"* is a slightly smaller form of the preceding, occurring in northern Durango, Mexico, north through most of New Mexico, northeastern Arizona, to southwest Colorado. It has a long, swinging gallop and is a splendid jumper. At Wichita, Kansas, some of these animals were seen to escape from an inclosure by clearing the fence which was seven feet high. At Fort Whipple, Arizona, Dr. Coues found this species "very common the year round. They chiefly affect grassy meadows and open glades, interspersed with copses, or clumps of oak trees, or patches of briery undergrowth. In the latitude of Fort Whipple the young are brought forth in June."

The Texas Jack "Rabbit" is not a symmetrical animal, nor is he a handsome creature, but "self-preservation is the first law of Nature" and he has wonderful powers of flight. He is not combative; on the contrary, he is very timid. These "Rabbits" are guarded by their invisibility when crouched in the forms, by their keen sense of sight and smell, and by their wonderful acuteness of hearing, for the augmentation of which their great ears have providentially been developed; but if danger comes too near they can usually escape by flight, a word that approaches literal accuracy as a description of a series of bounds, each from ten to fifteen feet in length.

They are very shrewd in throwing a dog off the trail; it is no unusual sight to see one make a run and outdistance the dog, then turn and retrace its steps on a back track for some distance, then give a tremendous leap to one side and squat in the grass until the dogs run by and lose its trail. When in flight they stretch out to their full length and their immense ears extend back perfectly straight.

The Texas Jack "Rabbit" when grown weighs from six to ten pounds, and measures from twenty-eight to thirty-six inches from the points of his long black-tipped ears to the hind toes when stretched out in a "sure enough" run when really frightened. They do not live in groups or communities, but they go upon the principle of every fellow for himself; it is rarely the case that two or more are seen together.

The *Great Plains Jack "Rabbit"* is another variety of the California Jack "Rabbit," ranging from northern Texas to southeastern Wyoming, and even Colorado east of the Rocky Mountains. It has shorter ears and a richer coloring than the California Jack "Rabbit." It is the species most common in the markets of Eastern States. It is speedy, deep-lunged, and obstinate, and is considered one of the best for coursing.

The Jack "Rabbit" has never been much in demand as an article of food until in recent years; it is now served by all of the leading hotels of the South, and many are shipped to northern hostelries, where they are looked upon as an attractive addition to the menu. If taken when half grown the hams and loins are most excellent and are preferred by many to even chicken or venison.

PYGMY HARE

Brachylagus idahoensis (*Merriam*)

Other Name.— Idaho Hare.

General Description.— Smallest of the North American Hares. Head of normal proportions; ears short; body not especially robust; legs, while long, not as long as in other Hares; tail very short; pelage quite long and soft; general color, drab gray mixed with black.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{3-3}{3-3}$=28.

Pelage.— ADULTS: Sexes identical, a noticeable seasonal variation occurring. *Winter.* Above, clear drab-gray, slightly mixed with black hairs; ears pale buff inside, dull buffy-ochraceous mixed with gray and black-tipped hairs outside, bordered anteriorly with black; nape of neck and feet dull ochraceous buff; breast grayish buff; belly whitish along the middle line only; rudimentary tail, above like back in color. *Summer.* Darker than winter; above, gray suffused with buff and intimately mixed with black. YOUNG: Like adults in the summer pelage.

Measurements.— Total length, 11.5 inches; tail vertebrae, .6 inch; hind foot, 2.8 inches; ear, 2.3 inches.

Range.— Sage brush plains of southern Idaho, southeastern Oregon, northeastern California and northern Nevada.

Food.— Plains vegetation.

Remarks.— This animal is unique, there being only the one species in the genus. Compared with its closest relatives in the United States, the Cottontail Rabbits, sufficient differences to justify the separation of the Idaho Hare are seen in the small size, shorter legs and rudimentary tail, as well as cranial characters not so obvious to the layman. For a long time this animal was known merely from a very few museum specimens, and it is only in recent years that anything has been learned of its habits.

This diminutive animal, which might with propriety be termed the Tom Thumb among Hares, being little more than ten inches in length, is an inhabitant of southern Idaho, southeastern Oregon, northeast California, and north and central Nevada. It has short, broad, and woolly ears, and a very short tail. Its legs are very short, and in running it keeps close to the ground and does not leap as do most of the other Hares.

This is a comparatively rare animal, and the scarcity of the specimens collected is explained by Dr. C. H. Merriam in "Results of a Biological Reconnoissance of South-Central Idaho" thus: "That but half a dozen specimens of this little rabbit were secured during more than two months spent in the very center of its abundance seemed very strange to us until we learned, near the close of the trip, two important facts con-

Photograph by H. T. Middleton

YOUNG COTTONTAIL RABBIT

A wild specimen captured when but a few days old

cerning its habits, namely, that it is almost exclusively nocturnal, and that it makes its home in deserted holes of the Badger. The only individual I succeeded in shooting was killed at the mouth of a Badger hole just at daylight."

The Idaho Pygmy Hare is the only American species known to dig its own burrows in the ground. Mr. Vernon Bailey states that "it commonly digs burrows, which are often connected on the surface with well-marked runways."

COTTONTAIL RABBIT

Sylvilagus floridanus (*Allen*)

General Description.—A medium-sized Rabbit with a short tail having a clear white underside, and carrying the tail over the back to show the white. Head fairly large; eyes large; ears of good size, fairly broad; body moderately robust; tail short; legs fairly long but hind legs not excessively longer than fore legs; pelage long, thick and soft; general color buffy gray mixed with black, above; underparts grayish-white. An animal of brushy areas.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{3-3}{3-3}$=28.

Pelage.— Adults: Sexes identical. A seasonal variation occurs but is not especially conspicuous. Above, buffy-gray mixed and lined with black; legs dark-rufous; a broad band across the chest, brownish-buff; ears broadly edged and tipped with black; nape of neck rusty; a white area about each eye; underparts grayish-white; tail above brown, beneath clear white. Young: Similar to adults but lacking strong black and rufous.

Measurements.— Total length, 18 inches; tail to end of hairs, 2.5 inches; hind foot, 3.4 inches; ear from notch, 2.3 inches.

Range.— Florida northward to North Carolina, west to Louisiana.

Food.— A great variety of green vegetation, leaves of shrubs, buds and bark of trees.

Remarks.— The Cottontail Rabbits may be readily distinguished from any of the related Hares and Rabbits by their shorter ears, shorter tail with its conspicuous white under-surface, and also by the pattern of coloration which is not duplicated outside of this group. There are 27 species and subspecies of Cottontails to be found north of the Rio Grande, and also a number that are found south of this river, so it is to be noted that the group is a very large one. This animal responds quite readily to its environment and thus many color differences are seen when animals from different regions are brought together.

Related Species

Florida Cottontail Rabbit.— *Sylvilagus floridanus floridanus* (Allen). Typical animal of the above description. Florida, northward to North Carolina, west to Louisiana.

Eastern Cottontail Rabbit.— *Sylvilagus floridanus mallurus* (Thomas). Larger, ears longer, color paler. East of Allegheny Mountains from Long Island, south to the Carolinas, and west to Alabama.

Texas Cottontail Rabbit.— *Sylvilagus floridanus chapmani* (Allen). Size small, sides and rump grayish-white. Middle and southern Texas.

Mearns Cottontail Rabbit.— *Sylvilagus floridanus mearnsii* (Allen). Size large, colors pale. West of Allegheny Mountains from Toronto, Canada, and central New York, west to Minnesota and Michigan; south to Kansas and Illinois.

New England Cottontail Rabbit.— *Sylvilagus transitionalis* (Bangs). Above, russet and wood brown mixed with black; nape of neck, hazel. New England States, south to Virginia and Georgia, north to Vermont, and southwestern Maine.

Nuttall's Cottontail Rabbit.— *Sylvilagus nuttallii nuttallii* (Bachman). Size small, colors pale. Plains and lower mountain slopes of Columbia River basin in eastern Washington and Oregon; also northeastern California, northwestern Nevada and western Idaho. Three subspecies in this group.

Audubon's Cottontail Rabbit.—*Sylvilagus audubonii audubonii* (Baird). Smaller than eastern Cottontail, ears longer; above, pale yellowish-brown mixed with black. Interior of north central California, south to San Francisco Bay.

Arizona Cottontail Rabbit.— *Sylvilagus audubonii arizonae* (Allen). Like Nuttall's Cottontail but smaller, with ears longer and broader, color paler. Deserts of southern Nevada, California and Arizona.

Bailey's Cottontail Rabbit.— *Sylvilagus audubonii baileyi* (Merriam). Large and pale, ears and tail longer. Plains and valleys from eastern Montana through Wyoming, northeastern Utah and Colorado, western North and South Dakota, Nebraska and Kansas.

Gray Cottontail, or Brush Rabbit.— *Sylvilagus bachmani cinerascens* (Allen). Much smaller, ears uniformly gray; above, yellowish-brown mixed with dark brown, general appearance of animal a grizzled gray. It is found in the arid valleys of southern California.

Oregon Cottontail Rabbit.— *Sylvilagus bachmani ubericolor* (Miller). Darkest and richest colored of the Cottontails; pelage very thick. Humid coast belt from northern California north to Columbia River, Oregon.

The Cottontail or Gray Rabbit, is a smaller animal than the Hare, and has, as a rule, shorter ears and shorter and weaker legs. Most of the species make use of burrows, openings in and under rocks, the abandoned homes of other mammals, or, if no dogs are about to chase them, a hole under a house or other building. Their color enables them to lie undetected in a tuft of overhanging grass, or a bunch of briers or bushes. In parts of Texas they live among the big bunches of prickly pears, seeming to ignore the presence of thorns in and along their trails. One of their favorite resorts for a mid-day nap is in or among the big flat pads of a prickly pear, where they will stick to their form until fairly forced out. The Long-eared or Arizona Cottontails make use of Prairie Dog holes to such an extent that the ranchmen call them "Prairie-dog Rabbits."

The Cottontail is one of the most familiar objects of our open fields. As the passer-by on a casual stroll comes too near its retreat, away it will scurry, its short, white stump of a tail waving defiance — or, more likely, it is the white flag of truce — for they are at heart timorous creatures. When captured, they will submit to half-taming, but always with a weather eye open to a means of escape. When placed in a cage they do not eat proffered food while their captor is present, but will remain stock-still for minutes, perhaps hours, at a time.

Photograph by H. E. Anthony

NUTTALL'S COTTONTAIL

This is a northwestern species, small in size and of pale color

Photograph by H. E. Anthony

FLORIDA COTTONTAIL

The Cottontail, or Gray Rabbit, is a smaller animal than the Hare

Their favorite food in summer is the inner bark of young trees and shrubs, green twigs, leaves, buds, and berries. As they do not store up food for the winter and do not hibernate, they eke out a rather scanty subsistence in the cold season from occasional wild rose or other hardy berries, and the bark of bushes. By spring they are lean and continually hungry. Indeed, they never seem to get enough to eat.

These Rabbits breed rapidly, often raising three litters in one year. As there are from four to six young at a birth, they would rapidly become a menace, if not kept in check by larger animals and birds of prey.

Photograph by the U. S. Biological Survey

EASTERN COTTONTAIL

This Rabbit and its kindred form a very large family, found in nearly every State in the Union. There are 27 species and subspecies north of the Rio Grande

The species most common east of the Alleghenies from Long Island and the lower Hudson Valley south to Florida is the *Eastern Cottontail.* It is yellowish-brown lined with black above; throat yellowish-gray; fore legs and outside of hind legs rusty; under parts white; tail yellowish-brown above, and white beneath. The females of this and most of the other species make soft, warm nests of fine grass, leaves and other vegetable material, lined with hair from their own bodies, and in these the young are born and lie concealed, like mice in a nest, while small and helpless. But they speedily gain strength and agility.

The *New England Cottontail* ranges the New England States to Maine and southwest to Virginia; also along the Alleghenies through West Virginia to Northern Georgia. It is of a size about equaling the Florida Cottontail, and differs from all other species in the almost uniform pinkish buff of its upper parts. It is increasing its range, and in certain parts of Vermont is slowly driving out the Varying Hare.

Audubon's, or Sacramento Valley Cottontail, the typical Western Cottontail, is found in the interior of north-central California from Sacramento Valley to San Joaquin Valley, and reaches the coast on the east and south sides of San Francisco Bay. It is a rather large Rabbit, dark ochraceous brown on the upper parts, and with most of the under parts pure white. It is characteristic of arid open plains, where it occupies not only the deserted holes of other mammals, and crevices in stone walls and rocky ledges, but even the space under floors of outbuildings about ranches. Families of six and eight of this species were found by Nelson living under deserted ranch houses.

SWAMP RABBIT

Sylvilagus aquaticus (*Bachman*)

General Description.—A good-sized Rabbit living in low, swampy woods and bottom lands with neither ears nor hind legs conspicuously elongated. Head small; ears short for a Rabbit; body of normal proportions; tail very short; legs long, hind legs longer than fore legs but not so much so as in the Prairie Hares; incisors very large; pelage harsh but thick; general color above ochraceous-brown, below white.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{3-3}{2-2}$; Molars, $\frac{3-3}{3-3} = 28$.

Pelage.— ADULTS: Sexes identical. Seasonal variation slight. General color above, ochraceous-brown lined with black; sides paler and with less black; breast dark yellowish-brown; chin and belly white; tail above dark reddish-brown, beneath white; a black spot on forehead; feet dark chestnut-brown; ears dark brown bordered with white in front, with fulvous behind; sometimes a black patch on cheeks; nape reddish-brown. YOUNG: Similar to adults.

Measurements.— Total length, 20.5 inches; tail vertebrae, 2.7 inches; hind feet, 4.2 inches.

Range.— River bottoms and swampy woods from Georgia west to middle Texas, and north to Oklahoma and Illinois.

Food.— Various plants and green vegetation.

Remarks.— The Swamp Rabbits are a well outlined, though small, group of North American Rabbits, separated from their kindred largely on the basis of cranial characters, but also by such superficial details as the shorter ears, tail and hind feet and the harsh pelage. Four species and subspecies of Swamp Rabbits are found north of the Rio Grande.

RELATED SPECIES

Swamp Rabbit.— *Sylvilagus aquaticus aquaticus* (Bachman). Typical animal as described above. Georgia north to southern Illinois, and west to middle Texas.

Coast Swamp Rabbit.— *Sylvilagus aquaticus littoralis* Nelson. Redder and darker. Narrow belt of swamps and marshes along the Gulf coast from Mississippi through Louisiana to Matagorda Bay, Texas.

Carolina Swamp Rabbit.— *Sylvilagus palustris palustris* (Bachman). Smaller and with under side of tail grayish instead of white. Lowlands along rivers and coast from North Carolina south to Florida.

Marsh Rabbit.— *Sylvilagus palustris paludicola* (Miller and Bangs). Dark reddish-brown with short broad ears. Peninsular Florida.

As its name implies, the Swamp Rabbit dwells among the bogs, swamps, and bottom-lands, and is thus not so well known as its cousins of the uplands. It is one of the most water-loving of the Rabbits, taking readily to water for food or to escape pursuit. In Texas, Vernon Bailey says, "they live in swamps, marshes, and low, brushy woods near the bayous, making trails that often lead through shallow water. They usually jump from under old logs, or tangles of briers and underbrush, and go dashing off with a heavy thumping run, but usually with speed enough to escape the dogs. Fires are said sometimes to drive them out of the swamps and marshes by hundreds." They are excellent swimmers, and when chased by dogs will swim back and forth across the creeks. Mr. H. P. Attwater says: "When frightened from their hiding places and chased by dogs they take refuge in hollow trees and in holes in the river bluffs. The dogs seem to have more difficulty in trailing them than they do the Cottontails and Jack Rabbits, the Swamp Rabbits often eluding the hounds by taking to water. I have seen them on several occasions swimming across the river while the dogs were hunting for them on the other side."

The *Marsh Rabbit* makes its home in the lowlands along rivers and the coast of the Southeastern States from Dismal Swamp, Virginia, south to Florida, and west to Mobile Bay, Alabama. It is seldom seen more than 500 feet above sea level. It is slightly larger than the average Cottontail, and runs low on the ground. It readily takes to the water, and if disturbed will plunge into the deepest bogs. Bachman states that it makes for its young a domed nest with an entrance on one side. In Peninsular Florida and the adjacent coast islands and north along the east coast to San Mateo, it is replaced by the *Carolina Swamp Rabbit*. This animal is the smallest, darkest, and most reddish-brown of the Marsh Rabbits and has short, broad, and rounded ears. It has short legs, and is somewhat clumsy, like an overgrown Rat, in appearance. It seldom roams higher than 100 feet above sea level.

Photograph by Dr. R. W. Shufeldt

YOUNG OPOSSUM

A life-size photograph of one of these queer beasts when a few weeks old. At birth they are immature, and are carried in an external pouch for six or eight weeks

ORDER OF POUCHED ANIMALS

(Marsupialia)

POUCHED Mammals, also known as Marsupials, are one of the most remarkable and distinctive of all the orders. Most of its members are confined to the Australian region, the Kangaroo being the most familiar type. Only one member, the Opossum, is found in North America.

The order takes its name from the external abdominal pouch of the female, in which the very small young are carried. A number of points in the embryology of the Marsupials, such as the extremely early birth and undeveloped condition of the young, show a wide separation from other orders. The one American family belongs to the *Polyprotodont* section of the Order, so called because of the character of the teeth, which are differentiated into incisors, canines, and molars.

The Opossums are a group that reach their greatest abundance in tropical and South America. The United States is in only the extreme northern portion of their range and thus we have only three sub-species found north of the Rio Grande. There is little liability of confusing this animal with any other North American type. The long prehensile tail, the grasping hind foot, the marsupial pouch, and the number of teeth are sufficiently characteristic to identify the Opossum, being found in no other mammal of the United States.

VIRGINIA OPOSSUM

Didelphis virginiana *Kerr*

General Description.— A good-sized mammal with long gray hair, about the size of a house cat, but with a long, naked tail. Head long and slender; muzzle bare; eyes small; ears large, naked; body rather thickset; tail prehensile; marsupial pouch present; limbs short; feet with five distinct toes, each provided with nails; first toe of hind foot which is nailless, large and opposed to the others for grasping; soles of feet naked; pelage externally composed of long coarse hairs in color grizzly gray; teeth sharp. An arboreal animal, and the only marsupial found in the United States.

Dental Formula.— Incisors, $\frac{5-5}{4-4}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{4-4}{4-4} = 50$.

Pelage.— Adults: Sexes identical; seasonal variation slight. Pelage of two coats; underfur short and soft, whitish; upper parts covered with black and white hairs, the latter longer, giving a grayish appearance; head yellowish-white; cheeks pure white; top of head and around eyes blackish; under parts dusky, intermixed with white hairs; legs and feet black; tail black at base, remainder yellowish-white; ears black with yellow spot on upper edge. Young: Quite similar to adults.

Measurements.— Total length, 30 inches; tail vertebrae, 12 inches; hind foot, 3 inches.

Range.— Atlantic Coast from New York to Florida and west to Mississippi and Texas.

Food.— Omnivorous; birds and eggs, mice, frogs, fish, insects and fruit.

Related Subspecies

Virginia Opossum.— *Didelphis virginiana virginiana* Kerr. Typical animal of the above description. Great Lakes to the Gulf Coast, and east to Hudson Valley and Florida.

Southern Opossum.— *Didelphis virginiana pigra* Bangs. Smaller and darker; tail longer. Florida, Georgia and Gulf Coast region to western Louisiana.

Texas Opossum.— *Didelphis marsupialis texensis* Allen. Size large; two color phrases, one black, the other gray. Coast region of Texas southward.

Among the North American mammals the Opossum is in a class by itself, inasmuch as it is a marsupial, or pouched animal. The pouch is on the ventral side of the body and serves as a nursery for the young. The young, from six to twelve, are born in a very immature state, blind, helpless, hairless, and very small, weighing from eighteen to twenty-five grains. The mother places the young in the pouch, where they are nourished and kept for about six to eight weeks. After this they venture out and climb over the body of the parent, clinging to her fur. At times the mother arches her tail over her back, as the Squirrel often does, and the little ones cling to it by their prehensile tails, heads down, and the forward feet touching her back, presenting a

Photograph by E. A. Briggs

TWO HUNGRY OPOSSUMS

These tame Opossums were "snapped" with a small folding pocket camera

curious sight indeed! For a few weeks after the young are able to climb out of the pouch they do not venture upon the ground, but return to the pouch for food and protection.

The Opossum is nocturnal in its general habits; emerging from its retreat at the close of day, from a hollow tree, a crevice in the rocks, or from under a building, wandering about in search of food. However, I have seen it abroad many times on cloudy days, and occasionally in the bright sunshine. Its menu is varied, but you may be sure it is a full one when it can be procured. Nature has provided the Opossum with teeth and a digestive apparatus indicating its omnivorous character, and an appetite for nearly all kinds of food. In its love for corn it resembles the Raccoon, breaking the stalks in the same manner and feeding upon the tender young kernels. An important part of its food consists of insects of various kinds. The Opossum is very destructive to the ground-nesting birds, destroying eggs and young alike whenever found. If an opportunity comes his way he dines from the poultry yard, and here he shows a decided preference for young chickens. But he should also be given full credit for the mice, moles, and young rabbits that he destroys.

It is in the South, on his native heath, that the Opossum reaches his greatest growth. For him the October sun and the frosts of November mature the juicy persimmon; and from early evening until break of day he lingers at Nature's banquet.

O, heedless Opossum! Could you but see into the future you would not feed thus recklessly upon the fruit, which in a few weeks must render you so temptingly fat! "'Simmon" time brings in "'Possum" time, and from many a cabin the melodious negro voices, accompanied by banjo, are heard singing:

> "'Possum am a cunnin' thing,
> He rambles in de dark,
> Nothin' 'tall disturb his min'
> But to hyah my bulldog bark."

The hunting of the Opossum in the South is one of the favorite sports among the colored people, and I will quote from Dr. Bushman:

"'Come, men,' says one, 'be lively, let us finish our task by four o'clock, and after sundown we will have a 'Possum hunt.'

"The paraphernalia belonging to this hunt are neither showy nor expensive. There are no horses, no costly guns imported to order, no pack of hounds answering to the echoing horn; only two or three curs, half hound, half terrier, each having his appropriate name, and each regarded by his owner as the best of the lot. A trail is soon struck, and the dogs all open up at once; in an instant they rush, pell mell, with a loud burst of mingled tongues, upon some animal along the edge of an old field destitute of trees. It proves to be an Opossum, detected in its nightly prowling expedition.

"At first, it feigns death, and rolling itself into a ball lies still on the ground; but the dogs are up to this 'Possum playing' and seize upon it at once. It utters a low growl or two, shows no fight, opens wide its large mouth, and with a few struggles, surrenders itself to its fate. But our hunters are not yet satisfied, either with the sport or the meat, so again they hie on the dogs. Another Opossum is soon started, and

Photograph by H. T. Middleton

AN OPOSSUM FAMILY

A mother Opossum and ten young. Four of the little ones are in the pouch

it hastens up the first small gum, oak, or persimmon tree within reach, and sits crouching on a limb, with eyes closed to avoid the light.

"'Off jacket, Jim, and shake him down!'

"As the fellow ascends, the animal continues mounting higher to get beyond his reach. Still he continues in pursuit until the Opossum has

ANTICIPATION

A familiar Southern scene, showing the "eternal triangle,"— the 'Possum, the Darkey, and the Dog

reached the extreme branches of the tree. The negro now commences shaking the pliant tree-top; while the Opossum, with its hind hands rendered convenient and flexible by its opposing thumb, and with its prehensile tail, holds on with great tenacity. But it cannot long resist the rapidly accumulating jerks and shocks. Suddenly the feet slip from the smooth, tiny limb, and it hangs suspended for a few moments only by its tail, in the meantime trying to regain its hold with its hind hands; but another sudden jerk breaks the limb, and down comes the poor animal, doubled up like a ball, into the opened jaws of its eager and relentless canine foes, and yields to fate without a struggle.

"In this manner half a dozen or more Opossums are sometimes captured before midnight."

The Opossum, although a very stupid animal, has one very clever trick. When attacked it simulates death most successfully. At such times the eyes are closed, the muscles are rigid, the breath suppressed, and no amount of rough handling will provoke any signs of life. The position assumed when "playing 'possum" is that which the animal usually takes when sleeping; the body is curled up, the head between the fore legs, the nose touching the stomach, and, upon the whole, it is the position best calculated to prevent injury from blows upon the head or breast. This art has probably saved many Opossums from destruction by other animals. Opossums that are partly tamed seem never to practice this peculiar trick. The present writer has found that the most effectual method of reviving the seemingly lifeless animal is to drop it into a pool of water. The immersion usually ends the "playing 'Possum" at once, and the animal speedily seeks the shore.

It is only just to say that there is a belief among many naturalists that the Opossum never "plays 'Possum," in an attempt to deceive. Says one: "Does the Opossum ever deliberately make the effort to deceive its captors by assuming such a position as to appear dead? If such be the case, it will be well to look beyond the mere fact of thus feigning death, and see what such an act, if voluntary, really indicates.

"First, the real object is to render itself useless or unattractive to its captors. Now, what is there in Opossum life that could give rise to such an inspiration? Could the experience of past generations, exposed as they were to the enemies characteristic of the different environment, do so?

"Then, in the second place, the assertion that the Opossum feigns death necessarily assumes that the animal in question realizes what death is. If so, then in fancying that we see death feigned on the part of the Opossum, we ascribe to it a process of reasoning which is fallacious, as the knowledge of death and its certainty is confined to man.

"Since this is the habit of the Opossum, it must necessarily have originated long prior to the advent of man upon the earth, and been acquired as a safeguard against the attacks of enemies not now existing, which would not

molest it if they supposed it to be dead. It is a habit that militates against its safety, and could never have been acquired in its present environment. Speed, if exercised, would in many cases insure safety, and the Opossum can run when it chooses to make the effort.

"Whatever the origin of the habit, if such it is, it cannot be logically regarded as voluntary. The brain of the Opossum is too primitive to have evolved this degree of cunning, forethought and contrivance."

In order to test the supposed habit, I have sought them out in their hiding places and endeavored to make them "show off." In one case an Opossum was captured in a box trap. On lifting the lid of the trap, the animal was found to be curled up into a form as nearly globular as possible. Being disturbed, it slowly raised its head, opened its mouth, but did not offer to bite, and in this position it quietly awaited coming events. After some five minutes of mutual staring, the Opossum closed its mouth and slowly restored its head to a more easy position, and even closed one eye, as though the other was all that was necessary to note what might occur. On being roughly handled and given several pushes with a stick, it again opened wide its mouth and protested against the disturbance by a low, hissing sound, but did not uncoil its body.

If the animal at that time realized that it was a prisoner, it certainly did not fear death, for it made no effort to escape, which fear of death would cause it to do, since it was in no way disabled. After waiting an hour, and seeing no signs of feigning unconsciousness, but, instead of it, a most provoking indifference, I walked off some distance to a point where I could see the trap, but was myself hidden from the Opossum. Fully ten minutes elapsed before I saw any movement on the part of the animal, and then it was a very gradual uncoiling of the body, a protracted yawn, a stretching of the limbs, and then, standing up, he looked about and very deliberately walked off. I ran toward him, seizing him by the tail, whereupon he recoiled his body and spread his jaws to the utmost. When I threatened violent blows about his head, it slowly sank, and the eyes closed, but this was not a feigned act. The breathing was affected, the surface temperature of the body was lowered, and I believe it was a true faint. Furthermore, as in fainting, the application of cold water had the effect of restoring the animal to consciousness. I have made scores of experiments of this kind, when the *fainting through fear* was more sudden, and in no experiments have I seen anything to suggest intentional feigning of death.

REALIZATION

Baked 'Possum and Sweet Potato are the joy of the Southern darky

Another observer, in speaking of the Opossums in the Southern States "being attacked by turkey buzzards, and going into 'spasms,' during which the buzzards injured the eyes of the Opossums and otherwise wounded them," says, "this being the ordinary result of a 'make-believe,' would even as foolish a creature as the Opossum long continue it?"

S. A. Lottridge.

ORDER OF TOOTHLESS ANIMALS

(Edentata)

THE name *Edentata*, meaning toothless, is not very appropriate for this large and widely differing order, since many members possess teeth. The name however, is correct to the extent that many of the teeth usually found in other mammals are missing in Edentates. The order is quite well-distributed throughout the world but has probably most representatives today in South America. Only one species of this order, the Armadillo, reaches the United States. The many strange types included in the order often have but few characters that serve to make them related. The best resemblances are seen in the teeth which are always either absent or very poorly developed, generally all of one type, never rooted, but with persistent pulps and usually deficient in enamel. Other families include the Sloths and Ant-eaters.

The Armadillo family comprises small to medium-sized Edentates having the greater part of the skin so strongly ossified as to resemble plates of armor, whence the name. Members of this family have teeth numerous, simple, and of persistent growth; skull with zygomatic arches complete; forefeet adapted for digging and scratching, with strongly developed curved claws, three to five in number; and hind feet plantigrade, with five toes all provided with nails.

TEXAS NINE-BANDED ARMADILLO

Dasypus novemcinctus texanus *(Bailey)*

General Description.—A peculiar-looking mammal with bony shell somewhat like a turtle. Head triangular in shape and covered with bony plates from between the ears almost to end of snout; ears large, naked; tail inclosed in twelve rings; covering of underparts not strongly ossified; limbs short; claws long; fore feet with four visible toes; hind feet with five toes. A burrowing mammal.

Dental Formula.— Incisors, $\frac{0-0}{0-0}$; Canines, $\frac{0-0}{0-0}$; Premolars, $\frac{0-0}{0-0}$; Molars, $\frac{8-8}{8-8}$ or $\frac{7-7}{7-7}$ =32 or 28.

Pelage.— ADULTS: Sexes identical, no seasonal variation. Almost hairless, a few scattered hairs to be found on head and under parts; shield on head pale brown; carapace or bony shield black with scutes on sides yellowish-white; tail brownish-black with anterior half of scutes yellowish-white; ears brown; toes yellowish; claws white; skin of head flesh color with a few yellowish hairs.

Measurements.— Total length, 32 inches; tail vertebrae, 14.8 inches; hind foot, 4 inches; carapace, 13 inches by 16 inches.

Range.— Texas south into Mexico.

Food.— Insects; mainly ants.

Remarks.— This Armadillo is not known to range farther north than southern Texas. To the southward, however, its range extends throughout South America. There is little likelihood of this animal with its peculiar bony carapace becoming confused with any other mammal. Only the one species comes under our consideration.

Photograph by Dr. R. W. Shufeldt

"PREPAREDNESS"

Nine-banded Armadillo rolling itself up into a ball, for protection

The Nine-banded Armadillo, an occasional visitor across our Southern border, is one of the curious survivors of a prehistoric family.

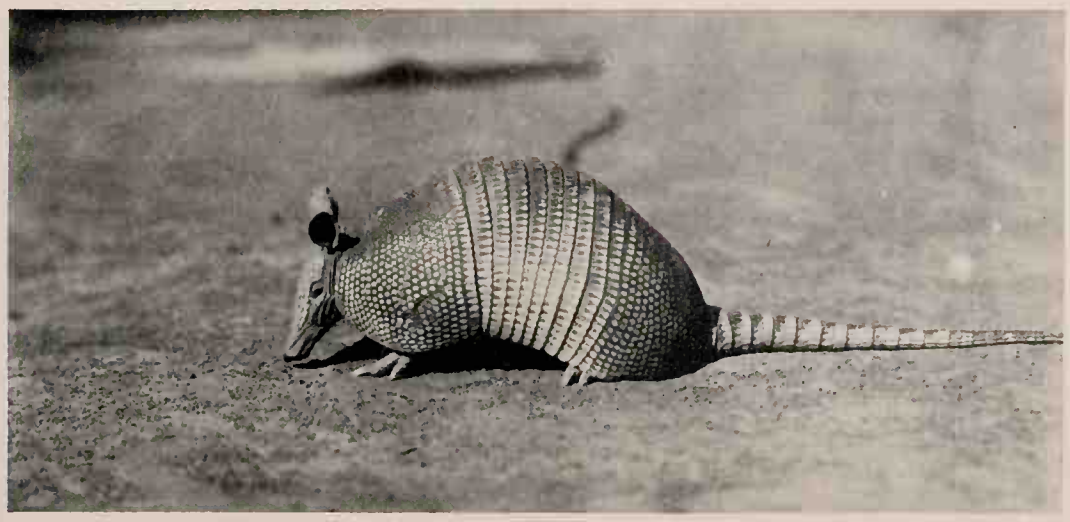
Ages ago, across the pampas of South America roamed a group of lumbering animals protected by huge dome-like shells. Some were provided with long tails studded with protective knobs like the armor of a knight. These prehistoric Armadillos were called Glyptodons, and their strong defensive armor protected them for a long time against their enemies.

The early Armadillos reached their largest size in Argentina. Thence they ranged northward, gradually dwindling both in size and numbers until today, in each respect, they are comparatively insignificant. Three species still are fairly common. These are known, from the leaves on their armor, as the "Three-banded," the "Six-banded," and the "Nine-banded" Armadillos. A fourth species, the Giant Armadillo, is practically extinct.

The Nine-banded Armadillo, our most northerly visitor, ranges north from Paraguay through tropical America to Mexico, and occasionally crosses the Rio Grande into Texas. It is an extensive range, and much larger than that of other species. The body is protected by a bony shell consisting of large sections joined in the middle by nine bony rings, which hinge into each other so neatly that the animal can literally roll itself up into an armor-encased ball. At the first hint of danger, up it rolls — even the top of its head being armored — thus presenting a tough nut for even the strongest animal to crack.

The Armadillo likewise finds both a shelter and a home by digging in the earth, its toes being armed with exceedingly long claws which penetrate rapidly into the hardest soil. These are practically all its means of defense, since while it can run rapidly, its legs are so short that it cannot go far. It cannot climb trees; and its lack of front teeth is a further weakness.

The Armadillo roams chiefly by night. It prefers the open country and is found on the most arid wastes. In movement it is quick, nervous, and furtive. It does not show any high marks of intelligence, but its chief propensity is to burrow. "In Venezuela," says Dr. Hornaday, "I found it burrowing on the open savannas, going down about four feet, in a hole seven inches in diameter. The flesh of this creature is well-flavored, and is generally esteemed as palatable food. Being in a state of perpetual hunger, we found Armadillo stew very much to our taste. In captivity its food is milk, boiled eggs, and chopped meat, but in a wild state it feeds upon a mixed diet of worms, ants, snails, beetles, small lizards, grasshoppers, and other insects. The young in a litter vary from six to ten."



ARMADILLO

The wonderful defensive armor of this strange beast is clearly shown from this life picture, taken near the Mexican border

ORDER OF INSECT-EATING ANIMALS

(Insectivora)

THE order *Insectivora* includes the small insect-eating mammals, the most familiar being the Mole and the Shrew. This order is a large one with many families which often do not bear very much resemblance to one another. In North America only two families are found, the *Talpidæ* or Moles, and the *Soricidæ* or Shrews. The North American Insectivores, and to a greater or less extent the other members of the order, present the following characters. The snout is long and projects beyond the lower jaw; the feet have five toes, provided with claws, and the animal is plantigrade or sub-plantigrade; the body is covered with soft fur; the teeth are numerous and the cusps sharp and prominent, but the differentiation into incisors, canines and molars is not carried out so far as in higher orders; clavicles are present; musk glands are present; and the animals are almost strictly insect and animal feeders. In both the North American families the eyes are exceedingly small and the ears are minute or rudimentary.

THE MOLE FAMILY

(Talpidæ)

MOLES furnish one of the strangest and most interesting marvels of Nature's handiwork. Here is a group of mammals destined from birth to life-long blindness; spending their whole lives in subterranean darkness; digging, digging, digging, in order to obtain the food necessary for their subsistence; rendering to the farmer a service that is simply inestimable in its value, yet regarded as animals worthy only of complete extermination. When of a morning we look upon the little ridges of new-turned soil disfiguring our lawns, we instinctively say "Those wretched moles again!" forgetting that the little shovellers have simply been working where they best could find their food. It is true that sometimes the tunnels dug by moles admit of the incursions of rodents which injure tubers, roots, and planted seeds; but it has yet to be proved that the harm done by Moles is not more than offset by their destruction of cutworms, wireworms, and other noxious pests of the husbandman.

So highly specialized are the Moles for a burrowing life that they possess structures found in no other mammals and consequently are quite easily identified. The very large fore feet, minute eyes and ears, short, thick tail, and velvety fur are strictly Mole characteristics.

The Moles of America are now classified by naturalists in five genera. Mr. Hartley H. T. Jackson, of the U. S. Bureau of Biological Survey, in "A Review of the American Moles" says: "Moles occur rather generally in eastern North America along the Atlantic and Gulf coasts from Labrador to Florida, and in northeastern Tamaulipas, Mexico, and range westward to Manitoba and northeastern Colorado. Within this area are found three genera, *Scalopus*, *Parascalops*, and *Condylura*. West of this area no Moles are found until the Pacific coast region is reached. There, two other genera, *Scapanus* and *Neurotrichus*, occur, their ranges being confined mainly to the humid and semi-humid region west of the Cascade Range, and the Sierra Nevada, from southern British Columbia to northern Lower California."

COMMON MOLE

Scalopus aquaticus (*Linnaeus*)

Other Names.— Eastern Mole, Naked-tailed Mole.

General Description.— A thick-set burrowing mammal with large and broad fore feet. Head narrow and pointed; muzzle naked and hog-like; no noticeable external ear; eyes minute and not visible externally; teeth numerous and sharp; neck very short; tail short and thick, nearly naked; limbs short; pelage soft and velvety. Strictly subterranean in habit.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3}$=40.

Pelage.— Adults: Sexes identical, no noticeable seasonal variation. A uniform lead color tinged with brown, in some lights appearing dark, in others silvery-gray; under parts like upper part; feet and tail white. Molt twice a year, in spring and fall. Young: Closely resembling adults.

Measurements.— Total length, 6 inches; tail vertebrae, 1 inch; hind foot, .8 inch.

Range.— Eastern United States south to Florida, westward to Mississippi.

Food.— Insects, largely beetles, and angle-worms.

Remarks.— Marked differences are noted in various species. The group to which the Eastern Mole belongs, *Scalopus*, with seven species and subspecies, is quite closely related to the Western Mole group, *Scapanus*, with eight species and subspecies, the latter differing mainly in cranial characters such as the possession of four more teeth. In separate groups we have the Star-nosed Mole, Brewer's Mole, and the Shrew Mole further described below.

Related Species

Common, or Eastern Mole.— *Scalopus aquaticus aquaticus* (Linnaeus). Typical animal of the above description. Eastern United States south to Florida, westward to Mississippi..

Prairie Mole.— *Scalopus aquaticus machrinus* (Rafinesque). Size large, slaty-brown. Mississippi Valley northward to Wisconsin and Minnesota, southward to Tennessee and Missouri, westward to Kansas, Nebraska and South Dakota.

Texas Mole.— *Scalopus aquaticus texanus* (Allen). Size small; pale chestnut-brown. Coast of Texas.

Copper-colored Mole.— *Scalopus aquaticus aereus* (Bangs). Larger than Texan Mole; color rich coppery-chestnut. Oklahoma.

Western Mole, or Townsend Mole.— *Scapanus townsendii* (Bachman). Largest of the Moles; blackish with purplish reflections. Coast range to Cascade Mountains of Washington and Oregon.

California Mole.— *Scapanus latimanus latimanus* (Bachman). Size moderate; grayish-brown. All California west of the Coast range, north to Oregon.

Anthony's Mole.— *Scapanus anthonyi* (Allen). Smallest of the true Moles; coloration silvery-gray. Southern California into lower California.

Star-nosed Mole.— *Condylura cristata* (Linnaeus). See special synopsis.

Brewer's Mole, or Hairy-tailed Mole.— *Parascalops breweri* (Bachman). See special synopsis.

Shrew Mole.— *Neurotrichus gibbsii gibbsii* (Baird). See special synopsis.

It has been aptly remarked that there is no common animal less common that the Common Mole. The disfiguring results of its labors are prominent on the lawns and in the fields; but the animal itself is seldom seen, and its habits are comparatively little known. It is most plentiful in meadows, gardens, and similar habitats, but is by no means confined to them, and frequently is found in open woodland, along the banks of streams, and in other environments.

The little mounds and ridges of upturned earth seen on our lawns are not true molehills, but merely the soil thrown up to the surface by Moles in digging their tunnels. Few persons have any idea of the rapidity with which these passages are excavated. The Mole's fore paws are about three-quarters of an inch wide and the palms are turned outward. Mr. Edward T. Martin, who has watched the animal at work, says: "In throwing dirt behind, it uses a motion like a boy in swimming, bringing the hands forward until they touch in front of the nose, then thrusting them outward and backward to push the soil aside, the body following in the passageway thus made."

The quickness with which a Mole works and the distance that it can tunnel in a given time are almost incredible. In a single night a Mole has been known to tunnel more than seventy-five yards; Dr. Merriam traced a fresh tunnel nearly a hundred yards; and Dr. Hornaday, observing the work of a Mole he had placed in a clover field at eleven o'clock in the morning, found that during the first seven hours it had tunneled twenty-three feet, in a zig-zag line. During the next seventeen hours thirty-five feet, and during the next hour ten feet more. The total work consisted of sixty-eight feet of main line and thirty-six and a half feet of branches, making in all one hundred and four and a half feet.

Proportionately to the animal's body, the arm and forearm are of enormous size; and, as has been seen, tremendously powerful. Sometimes

the tunnels are but five or six inches below the surface; but they have been found at a depth of four feet or more, undoubtedly the result of the Mole pursuing worms and insects into moister regions. The Common Mole seldom leaves its tunnels, of which there are two lines, one above the other. Mr. Jackson thinks the upper tunnel may be used but once, during the animal's hunt for food, but that the main one may be used for a considerable time.

In the northern half of its range, the young of the Common Mole are born hairless, in March or April; in the southern half, later. There is probably only one litter annually, and this varies from two to five, the usual number being four. The nest is about five or six inches in diameter and usually twelve to eighteen inches below the surface. Most frequently it is placed under roots of shrubs or pasture grass and is made of grass and rootlets, but occasionally partly of leaves.

The fur, which is molted twice a year, is soft and velvet-like. It is in considerable demand for trimmings and garments. In 1913 there were 1,455,124 moleskins sold at the London auctions. These were largely from the European Mole; but the American skins are equally good, and, when from the colder districts, possibly better.

The fur is always very clean, which is to be wondered at when we think of how much of his time is spent in forcing his way through the earth. The fact that he is not soiled by contact with the earth is explained when we examine his fur. Instead of the hairs being large at the bottom and tapering toward the outer end, or of even thickness throughout, as in other animals, they are small where they leave the skin and increase toward the center, growing smaller again at the outer ends. This is the reason his fur is not ruffled by being rubbed in any direction, and explains why it does not take up the earth as readily as the hair of other animals does. But there is still another reason why "dust does not stick to him." Under the Mole's skin there is a muscle-membrane, and from time to time he moves this muscle violently so as to shake the earth from his fur.

Moles are very quarrelsome and frequently fight when they meet. A graphic account of

Photograph from the West Va. University Experiment Station

COMMON MOLE

Though one of our commonest animals, little is generally known about this mysterious prowler — one of the most voracious of all living things

one of their battles, is given by a passer-by who happened to witness it: "Walking along a quiet lane, I heard some very funny little squeaks proceeding from the other side of the hedge. I am perfectly used to all sorts of animal and bird sounds, but had never heard the like of these before. On getting cautiously over the hedge, I found two Moles fighting in the ditch. I went to within two yards of them, but they took not the slightest notice of me, so intent were both on their business. I at once looked at my watch. They kept on, up and down, scratch and bite, for seven minutes, when one turned the other completely over on his back, and seized him by the throat, which he cut as cleanly as if done by a knife, thus finishing the fight. The way in which they used their formidable front feet was surprising."

The Mole is one of the most voracious of all animals. If it were the size of a Lion or Tiger it would be by far the most terrible creature that we could imagine, for its fierceness is proverbial. Its insatiable appetite constantly demands food. Mr. L. E. Adams says: "The accounts of the short periods of starvation necessary to kill a Mole are borne out by my observations. On one occasion I caught a vigorous Mole, quite unhurt, and fed him at intervals during the day with about a third of a pint of worms, besides which he had several drinks of water. At night, about eight o'clock, I dug about a third of a pint of worms, and put them into his den (a packing case with earth at the bottom) and left him. In the morning I found him very feeble, thin and cold. I took him up in my hand and put his nose to some water, which he seemed to enjoy, but he was too feeble to tackle a worm, and presently, after a gentle convulsion, he died in my hand. I found on dissecting him that the stomach was absolutely empty, in spite of the fact that he had eaten every worm left for him."

That the Mole is a friend of the farmer is shown by a test made by Mr. Fred E. Brooks of the West Virginia University Agricultural Experiment Station: "I kept one large Mole in a box half filled with earth for thirty-three days. It was fed daily on earthworms, insects, and flesh of other kinds, of which it ate a surprising quantity. Several potatoes were kept in the box during most of the period, but the Mole did not once sample them. In the space of twenty-four hours, this Mole ate fifty large white grubs, one "chestnut worm," one wire worm, one cicada nymph, forty-five larvae of "rose bugs," and thirteen earthworms. The insects weighed forty-two grams and the earthworms twenty-four grams, making a total of sixty-six grams. The Mole itself weighed fifty grams, or about four-fifths as much as the food taken. It should be mentioned here that it was the custom of this Mole in eating earthworms to take one end of the worm in its mouth and then draw the body between its claws in such a way as to force out all the earthy matter from the digestive organs. The weight, therefore, given for the earthworms, is likely a little too great, as this discarded portion would have weighed a few grams. However, after deducting it from the quantity given, that remaining would still weigh more than the Mole itself. The Mole had been well supplied with food up to the time the test began, and I believe that the figures represent a fair daily average of the food consumed. If correct, a single Mole would eat in the course of a year something like 40,000 insects and worms, which would weigh over fifty pounds.

"Two days later I caught a Mole and confined it in a box similar to the one in which the Mole just described was kept. The Mole was caught by hand and was not injured in any way. Water, but no food except potatoes, was given it. Early on the following morning it died of starvation. One of the potatoes was found to be slightly scratched as by the Mole's teeth or claws, but, if any had been eaten, the amount was very small. No trace of potato was found in the stomach. Later, another Mole in captivity died in a similar manner when given nothing but potatoes."

The results of these experiments agree with what economic zoologists long ago found out, that the accusations made against Moles of eating potatoes and other vegetables in the field, are almost, or entirely, groundless. They also agree with the account given by Adams, showing the inability of Moles to undergo more than a very brief period of starvation.

This strange little beast seems adapted by nature to the simplest and most mechanical of functions. Its senses are rudimentary, that of sight being almost entirely lacking. Its eyeball is only about the size of a pinhead, and probably all it can distinguish is strong light from darkness. The changing seasons and all the bright busy world above it pass unheeded, in its blind patient search for food, and still more food.

The *Western*, or *Townsend's Mole* is the largest of the genus *Scapanus*, being over eight and

three-quarters inches in length. In its winter pelage its upper parts are blackish-brown to almost black, usually with a purplish sheen; the under parts are slightly paler. In summer, the purplish sheen is more pronounced. Its habits do not differ widely from those of the Common Mole, except in regard to breeding, the young being usually born in May or June. The number of young ones is two or three, seldom four, and not infrequently only one. Like all the species and subspecies of this genus, of which there are eleven, Townsend's Mole is found in the Pacific coast region, its range extending over the extreme northwest of California, Oregon, and that part of Washington west of the Cascade Mountains.

STAR-NOSED MOLE

Condylura cristata (*Linnaeus*)

General Description.— Similar to Eastern Mole, but nostrils with a curious, fleshy, star-shaped pad formed by twenty-two cutaneous processes. Feet scaly; tail three-quarters as long as body, covered with scattered hairs, constricted at base; fore feet broad.

Dental Formula.— Incisors, $\frac{3-3}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{4-4}{4-4}$; Molars, $\frac{3-3}{3-3} = 44$.

Pelage.— ADULTS: Sexes identical; seasonal variation slight. Above dusky brown or blackish; below paler and grayer on sides of throat and chin; tail more or less covered with blackish hairs; feet dusky. In winter the tail is enlarged. YOUNG: Similar to adults.

Measurements.— Total length about 7 inches; tail vertebrae, 2.7 inches; hind foot with claw, 1 inch.

Range.— Eastern North America north to 51°, from Manitoba to the Atlantic, and south to Illinois, Virginia, and in the Allegheny Mountains to the boundary of South Carolina.

Food.— Insects and worms.

Remarks.— Although closely related to the Eastern Mole, the Star-nosed Mole is characterized by significant features such as its star nose and different dentition, and is therefore placed in a genus by itself. There is only the one species known of this peculiarly marked animal.

TWO VIEWS OF THE MOLE

The interior view, showing the peculiar curving form of the skeleton, was revealed by the Roentgen rays

This Mole, which is the only representative of the genus *Condylura,* is notable for its remarkable nose, which terminates in a naked disk surrounded on its margin by a fringe of twenty-two feelers symmetrically arranged, eleven on each side of a median line. It is found in southeastern Canada from southern Labrador to Manitoba, and as far south as South Carolina.

Though occasionally occupying the same tunnels as the Common Mole, this species prefers to make its home in wet meadows and marshes. The ridges of earth made by it are more irregular than those of the Common Mole, more crooked, and smaller. Unlike its cousins it frequently leaves its tunnels in winter, and burrows in the snow, even running on top of it.

Little is known about the breeding and nesting habits of this Mole. There is in the Biological Survey collection a family of five young, about one-third grown, which, according to Jackson, was found in a nest under a log on the flats of the Potomac river a short distance north of Georgetown. Bishop, writing of some young that were probably ten days old, said, "the fur was just beginning to start, which gave the skin a dark-brown color."

Mr. Francis H. Allen contributes to *Science* some interesting information concerning a Star-nosed Mole that he caught entering a half-rotten willow stump, at the edge of a little pond in the woods at West Roxbury, Mass., and placed in a cage at his home. He writes: "I dug some

earthworms and placed them one by one in the cage. Apparently the Mole's power of scent is nearly as weak as its eyesight, for it paid no attention to the worms unless they were dropped directly in the path it pursued about the edge of the cage. When it actually ran its nose into one, it ate it with astonishing greediness and in a curiously piggish way, with a constant shaking of the head, and shuffling the worm into its mouth with the help of its hands, which it moved in unison. It devoured ten worms before its appetite began to flag. One very large one it abandoned after cutting it into three pieces by bites. I heard no noise of teeth, as described by Audubon. A saucer of water was not noticed for some time; finally it put its nose into it and drank with the same motion of the head. It then tipped up the saucer, spilled the water, and then seemed to drink it off the board in a way that reminded one of sponging out the bottom of a boat. It continued the same operation on the dry part of the board, as if it could not tell where the water ended, except by feeling." There was nothing nervous about the actions of this Mole, and Mr. Allen estimated that the creature's intelligence did not rise much above "life, liberty, and the pursuit of earthworms."

Hawks and owls are among the enemies of the Star-nosed Mole, but they must be on the alert, in order to surprise it above ground.

BREWER'S MOLE

Parascalops breweri (*Bachman*)

Other Name.— Hairy-tailed Mole.

General Description.— A large Mole, with thick, short and densely-haired tail; nostrils simple and crescent-shaped; eyes and ears small; limbs short; fore paws powerful.

Dental Formula.— Same as Eastern Mole.

Pelage.— General tone fuscous-black, slightly paler and more grayish on under parts; hairs on feet, and usually on nose and tail, more brownish, often becoming white in old adults; throats and underparts sometimes stained with Dresden brown.

Measurements.— Total length, 7 inches; tail vertebrae, 1.2 inches; hind foot, .8 inches.

Range.— From mountains of North Carolina, West Virginia, and southeastern Ohio, northeastward through Pennsylvania, New Jersey and New York, to New Brunswick.

Food.— Insects and worms.

Remarks.— Brewer's Mole is the only representative of the genus *Parascalops*. The peculiar marks of this genus are noted above. It is seldom found in the haunts of the Common Mole.

Brewer's Mole deserves special attention from the fact that, like the Star-nosed and the Shrew Moles, it has certain distinguishing marks which place it in a class by itself. In habits, however, it differs little if any from its cousins.

It is found from southern New Brunswick to the Appalachian Mountains, and as far south as North Carolina. Curiously enough, although dwelling in the immediate range of the Common Mole, the two are seldom found together.

Brewer's Mole, often called the Hairy-tailed Mole, is a little under seven inches in length; its nostrils are crescentic, with concavity upward; the tail is short, thick, and densely covered with hair. This Mole is very difficult to trap, and little is known concerning its breeding habits and times of molting. Its general habits, as stated above, are believed to be much the same as those of the Common Mole. It subsists upon worms, grubs and other insect food.

SHREW MOLE

Neurotrichus gibbsii (*Baird*)

General Description.— A very small Mole lacking the wide fore feet. Head small; snout elongate; eyes and ears minute; body only moderately thick-set; tail fairly long, thick and hairy; limbs short; fore feet somewhat expanded and larger than hind feet; claws long, acute, compressed; upper and under surface of all feet covered with small plates; nostrils simple, naked; pelage soft but not so velvety as in the larger Moles.

Dental Formula.— Incisors, $\frac{2-2}{1-1}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{4-4}$; Molars, $\frac{3-3}{3-3}=36$.

Pelage.— Adults: Sexes identical; seasonal variation not conspicuous. Dark sooty-brown above, very

little lighter below; some of the hairs more lustrous than others giving a hoary appearance. YOUNG: Similar to adults.

Measurements.— Total length, 5.5 inches; tail vertebrae, 1.5 inches; hind foot, .7 inch.

Range.— Fraser River, British Columbia, west to Cascade and Sierra Nevada Mountains, south to Shasta County, California.

Food.— Insects and worms.

Remarks.— The Shrew Mole appears to be a connecting form between the Shrews and the Moles but is rather more mole-like and is consequently placed in the Mole family. That it has not reached such a high degree of specialization as the large Moles is at once apparent from an examination of the fore feet. There are three subspecies.

RELATED SUBSPECIES

Shrew Mole.— *Neurotrichus gibbsii gibbsii* (Baird). Typical animal as described above. Pacific Coast of North America from Fraser River, British Columbia, to northern California.

Big Shrew Mole.— *Neurotrichus gibbsii major* Merriam. Larger, tail longer, feet larger, underparts darker. Mount Shasta region, California.

Hyacinthine Shrew Mole.— *Neurotrichus gibbsii hyacinthinus* Bangs. Larger than the Shrew Mole; black with green and purple reflections. Marin County, California.

This is the smallest of all American Moles. The snout terminates in a naked disk or pad; the ear opening is large; and the tail is long and thick, and sparsely covered with coarse hairs. The fore feet are not so handlike as those of the other Moles, and the toes are not webbed. It is, in fact, a connecting link between the Moles and the Shrews, as its name indicates. It occupies a separate genus, called *Neurotrichus*.

This little animal is found in the extreme southwestern part of British Columbia, western Washington, and Oregon west of the Cascade Mountains, south in the coast region to Eureka, California, and also in the interior.

According to Jackson, "the little *Neurotrichus* prefers a damp habitat and is seldom found far from swamps, marshes, or streams. In the extreme southern part of its range it is most frequently found in swampy places overgrown with sedges or shrubs. Farther north its habitat is less confined and it is found along streams or even in moist dense woods."

The tunnels of the Shrew Mole resemble those of the Star-nosed Mole more than those of others, and it spends a great deal of its time under logs or in surface runways. Its tunnels are very like those of the eastern Pine Mouse, being often open above for some distance.

Photograph from the West Va. University Experiment Station.

BREWER'S MOLE

About two-thirds natural size. This animal does not eat potatoes or other vegetables, but feeds extensively on earthworms and white grubs

THE SHREW FAMILY

(*Soricidæ*)

SHREWS constitute the largest family of the Insectivores, and include the smallest of all mammals. These tiny animals, some of them but little more than three inches long, are sometimes mistaken for Moles and, more often, as they scuttle through the grass or fallen leaves, for Mice. In the gardens and in the woods, in the dry fields and in swamps and marshes, on the plains and in high mountains, a Shrew of some sort is usually to be found.

Many of the Shrews are hardy little creatures, and some of the northern species may be seen abroad even in the cold of an Arctic winter. Although they are classed among the insect-eating mammals, insects are not their only food. Dr. D. G. Elliot says: "They do not confine themselves by any means to an insectivorous diet, but devour worms, small birds or any scraps of meat that fall in their way."

The Shrews are characterized as very small Insectivores with mouse-like forms and long slender snouts. They have well-furred bodies and well-developed tails usually covered with short hairs. The eyes and ears are small; the feet are slender or only slightly widened; the skull has no zygomata. Most of the Shrews are terrestrial, but a few are aquatic. This family contains more than half the representatives of the order.

For present purposes, the Shrews of America may conveniently be divided into four groups, namely: Long-tailed Shrews (genus *Sorex*); Small Shrews (*Microsorex*); Short-tailed Shrews (*Blarina* and *Notiosorex*); and Swimming Shrews (*Neosorex* and *Atophyrax*).

COMMON SHREW

Sorex personatus *I. Geoffroy*

Other Names.— Long-tailed Shrew, Cooper's Shrew, Masked Shrew, Shrew Mouse.

General Description.— A very small mammal with a sharp nose, minute eyes, and fairly long tail. Ears small and nearly hidden by hair of head; teeth sharp and stained with chestnut at the tips; body slender; legs short and slender; pelage thick and soft. An active, quick-moving little animal.

Dental Formula.— Incisors, $\frac{4-4}{2-2}$; Canines, $\frac{1-1}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3}$=32.

Pelage.— ADULTS: Sexes identical; seasonal variation slight. Above, sepia-brown and occasionally chestnut; below, ashy-gray or brownish-ash; tail above blackish, below whitish. YOUNG: Like adults.

Measurements.— Total length, 4 inches; tail vertebrae, 1.5 inches; hind foot, .5 inch. Weight, 2.85 grammes, or 43.95 grains.

Range.— North America from New England to Alaska, except the southern Rocky Mountains and Cascade Sierra systems; south in Alleghenies to Tennessee and North Carolina.

Food.— Insects, and any animal food it can secure.

Remarks.— Six genera go to make up this group, for specialization along several main lines has taken place. The genus *Sorex* with 42 species and subspecies is easily the largest group, and most of its members vary superficially only in color and somewhat in size. The related genera vary more widely in proportions of parts and in special adaptations to be discussed in the synopsis of these forms. There are 66 species and subspecies in all.

RELATED SPECIES

Common Shrew.— *Sorex personatus personatus* I. Geoffroy. Typical animal as described above. North America from New England to Alaska, south to Tennessee and North Carolina in the Alleghenies, but not found in the southern Rocky Mountains and the Cascade-Sierra systems.

Richardson's Shrew.— *Sorex richardsonii* Bachman. Larger, back very dark brown, sides fulvous-brown, under parts ashy-plumbeous. Plains of Saskatchewan, and in Minnesota and Wisconsin.

Arctic Shrew.— *Sorex sphagnicola* Coues. Size medium; above, dark seal-brown, grayish-brown below.

Extreme northern British Columbia to Hudson Bay.

Wandering Shrew.— *Sorex vagrans vagrans* Baird. Size small; tail as long as head and body; dark brown or russet on upper parts. Southern British Columbia, western Washington, Oregon and northern California.

Dusky Shrew.— *Sorex obscurus obscurus* Merriam. Larger than Wandering Shrew or Common Shrew; sepia-brown above. British Columbia and mountains of Washington, Idaho, Montana, Wyoming, Utah and Colorado south into California.

Trowbridge's Shrew.— *Sorex trowbridgii* Baird. Size large; sooty brown or black. Western Washington and Oregon.

California Shrew.— *Sorex californicus californicus* Merriam. Size small; above, dark ash-gray and blackish. Central California.

Fisher's Shrew.— *Sorex fisheri* Merriam. Size large; dull chestnut-brown above. Virginia and North Carolina.

Pacific Shrew.— *Sorex pacificus* Coues. Largest Shrew of the genus *Sorex*; length about 6 inches; cinnamon-rufous above. Pacific Coast from Point Reyes, California, to Yaquina Bay, Oregon.

Pygmy Shrew, or Hoy's Shrew.— *Microsorex hoyi* (Baird). Smallest of all the Shrews and smallest North American mammal; total length, 3.2 inches; tail vertebrae, 1.25 inches; sepia-brown above, paler below. Wisconsin to North Dakota and British Columbia.

Short-tailed Shrew.— *Blarina brevicauda* (Say). See special synopsis.

Water Shrew.— *Neosorex palustris* (Richardson). See special synopsis.

Photograph by West Va. University Experiment Station

SHORT-TAILED SHREW

Shrews are even less known than Moles, due to their retiring disposition, but are hardly less numerous

"Considering the abundance of these animals," says Samuel N. Rhoads, "it seems strange that the name 'Shrew' has not come into more general use, especially among persons who live in the country and see them often. When referred to on the farm they are almost invariably designed 'Mole' or 'Mouse' and the name 'Shrew' is scarcely recognized as belonging to a North American animal. The Shrews constitute a family by themselves, however, and may very easily be distinguished from the Moles by their smaller size and Mouse-like fore feet, and from the Mice by their pointed nose, small eyes and finer fur."

The Common Shrew has a wider range than any other of the long-tailed group; indeed its area of distribution is larger than that of any other American species, extending across the entire continent from Alaska to New England except the southern Rocky Mountains and the Cascade-Sierra systems. In the South it is found in the higher Alleghenies to Tennessee and North Carolina. It is known by various names, as Cooper's Shrew, the Masked Shrew, and the Shrew Mouse.

This diminutive animal makes its home in the hollow parts of fallen trees, under wood piles or logs, or in any sheltered place where it is likely to be undisturbed. It does not burrow; but Mr. Theo. H. Scheffer, of the U. S. Biological Survey, has found that it is a frequent trespasser in the underground galleries of the Mole. Though not aquatic, it prefers to dwell near some small stream that will not freeze in winter nor run dry or stagnate in summer. A very dry summer means death to numbers of

Shrews. In winter the Common Shrew may be seen poking its snout into the little openings in the bark on the lower parts of tree-trunks, and ferreting about in the leaf mold or among pieces of decayed wood for its daily bread. It is supposed that the species mates without much regard to seasons, but on this point little is known definitely.

The ears of the Shrew are more evident than those of the Mole. The toes are furnished with claws, usually five on each foot. Shrews, however, never walk on their toes, but plant the greater part of the sole on the ground. Many of the species have glands, usually on the sides of the body, which emit a noxious odor when the animal is frightened or enraged, serving to protect it from many, but not all, of its forest enemies. Weasels, owls of all kinds, and some hawks kill and eat Shrews; but the mink, fox, most of the hawks and domestic cats, though they frequently kill them, only feed on them when forced by hunger to do so.

The Shrew's fur, like that of the Mole, is soft and silky, and all of the American species have their summer and winter coats. The summer pelage is usually sepia brown or chestnut; the winter one, dusky or ash-gray or lead-colored.

Shrews, so far as known, do not hibernate, nor do they seem to lay by provision for the winter, so that they are necessarily compelled to hunt unceasingly for their food in all kinds of weather and at all seasons of the year.

Considering its size, the Shrew may be considered one of the most pugnacious of all animals. Mr. Fred E. Brooks says: "I recently placed a Shrew, about two-thirds grown, in a box with a mature and very large Meadow Mouse. They lived together for about a week before they were separated, but the relationship between the two seemed at all times to be decidedly strained. Each seemed to fear the other, although the Mouse was at least four times the size of the Shrew. I fed the two a great many grasshoppers, of which both were very fond. The one that got hold of a grasshopper first would keep it without personal violence being resorted to by the other for its possession. When the Mouse was eating food that the Shrew desired, the latter would often take a position near at hand, usually at the mouth of one of its burrows in the moss with which the box was partly filled, and indulge in a peculiar and rather amusing performance. With its mouth wide open and its snout and lips drawn back so as to expose its sharp teeth, it would throw its head rapidly from side to side and give forth a peculiar, song-like chatter consisting of a series of rapidly repeated chirps, pitched on a high key, and varied every few seconds with a long-drawn, rasping note on a lower key. While thus engaged it would assume a perfectly fiendish look and express in the most realistic manner all the anger and envy and hate that was in its little heart."

House Mice, White-footed Mice and Meadow Mice, when confined in a cage with Shrews, will often manifest the most abject terror, and will jump and rush about as though panic-stricken until exhausted. The evident hate and fear with which they regard the Shrews indicate that they recognize in them a natural and puissant enemy which for reasons of personal safety they must avoid.

The *Pygmy Shrews* deserve especial notice as they occupy a group by themselves, which contains three species. The smallest of these, and in fact the smallest of all our mammals, is Hoy's Shrew. This diminutive creature has a total length of only a little over three inches, the tail measuring one-third of this; so the little body is about two inches long. The pelage is chestnut-brown with a little hoariness in the upper parts; the under parts dull rusty white. Its range is a wide one, extending from British Columbia to Labrador.

Practically nothing is known of the habits of this little animal. Mr. G. S. Miller, Jr., says: "Hoy's Shrew avoids bogs and heavy woods. At North Bay I invariably found it in dry clearings and gardens. The one taken at Peninsula Harbor was found by a dog under the rotting trunk of a small tree in an open upland prairie. A female taken at North Bay had only four mammae."

SHORT-TAILED SHREW

Blarina brevicauda (*Say*)

Other Name.— Mole Shrew.

General Description.— A typical Shrew resembling superficially the Common Shrew but much larger, with heavier body, and very short tail. Head pointed; ears short; eyes small; legs short; pelage soft and glossy.

Dental Formula.— Incisors, $\frac{4-4}{2-2}$; Canines, $\frac{1-1}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3}$=32.

Pelage.— ADULTS: Sexes identical; seasonal variation slight, summer coat paler than winter. Above, sooty plumbeous; below, ashy plumbeous; tail dark above, paler below; pelage very soft and glossy. YOUNG: Similar to adults.

Measurements.— Total length, 5 inches; tail vertebrae, 1 inch; hind foot, .62 inch. Weight, 22 grammes.

Range.— Western Nebraska and Manitoba eastward to the Atlantic Coast.

Food.— Insects and Meadow Mice.

Remarks.— The short-tailed and thick-set body of this Shrew serves to distinguish it from others. It is probably the largest, considered from the point of weight, of all the Shrews. Some nine species are known north of the Rio Grande.

RELATED SPECIES

Common Short-tailed Shrew.— *Blarina brevicauda brevicauda* (Say). Typical animal of the above description. Western Nebraska and Manitoba eastward to the Atlantic.

Carolina Short-tailed Shrew.— *Blarina brevicauda carolinensis* (Bachman). Smaller than the Common Short-tailed Shrew and generally browner. From mouth of Chesapeake Bay to Arkansas.

Florida Short-tailed Shrew.— *Blarina brevicauda peninsulae* (Merriam). Color more slaty and hind feet larger than the Common Short-tailed Shrew. Peninsula of Florida south of latitude 28°.

Small Short-tailed Shrew— *Cryptotis* (= *Blarina*) *parva* (Say). Size very small; teeth, 32 in number; upper parts dark hair-brown; under parts ashy-gray; total length about 3.12 inches. Eastern United States from Texas and eastern Nebraska, eastward to the Atlantic Coast.

The Short-tailed Shrew differs both in characters and in habits from its long-tailed cousin. As its popular name indicates, it resembles the Common Mole, for which animal it is often mistaken. It is equally often supposed to be a Field Mouse, its lead-colored pelage contributing to this illusion.

"It is surprising how few, even among very intelligent people, have the remotest conception of what constitutes a Shrew," observes Samuel

Photograph by the West Va. University Experiment Station

SHORT-TAILED SHREW

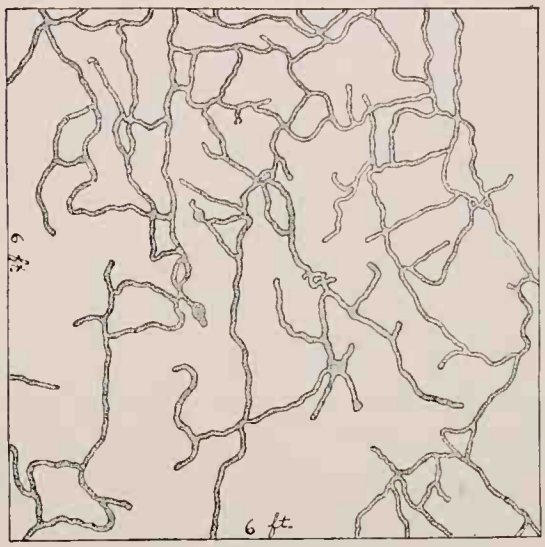
An excellent life-size photograph of an animal that is often mistaken for the Mole

N. Rhoads. "I venture that ninety per cent of the persons I have conversed with on the subject have had no idea of Shrews other than the kind depicted in Shakespeare's comedy, and when I gravely state to them that I have caught so many Shrews the effect is rather amusing. Though rarely seen, even by the most curious observers of nature, the subject of this article far outnumbers any other species of native mammal found in eastern North America.

"This species stands pre-eminent above all others of our mammals in its abundance and universality of distribution in all conceivable situations. Not a place have I trapped over in the two States (New Jersey and Pennsylvania) but what it was among the first to be caught. It is found in our deepest, coldest mountain ravines, on the stony, barren mountain top, in the banks and valleys of low tide-water streams and the maritime marshes, and delights in roving from the cool sphagnum bogs of the New Jersey cedar swamps, where the temperature may be below 60 degrees, to the hot sand barrens of the adjoining fields with a midday heat of 110 degrees. Forest and plain, sand and clay, barren or fruitful fields, backwoods and dooryard, heat and cold, wet and dry, day and night, have common charms for this little cosmopolite."

Like other members of the family it is both insectivorous and carnivorous, depending almost wholly on animal food for subsistence, and with its near kinsman the Mole, which it greatly resembles, is supposed to feed principally on worms. In view of their great numbers we naturally ask what economic relations they bear to man and to nature. Undoubtedly the purely mechanical effect of their universal burrowing and rooting in the soil is an important factor. It is known that they subsist to some extent on vegetable food, chiefly nuts, but they do only indirect damage to agriculture by disturbing the roots of plants. On the other hand, there is little doubt that they destroy an amazing number of noxious grubs, beetles and worms, and it is probable that the part they play as underground scavengers is important. They also do much in checking the increase of the native Mice of our meadows and woodlands.

Theodore Roosevelt says: "When a boy I captured one of these Mole Shrews and found to my astonishment that he was a blood-thirsty and formidable little beast of prey. He speedily killed and ate a partially grown White-footed Mouse which I put in the same cage with him. (I think a full-grown Mouse of this kind would be an overmatch for a Shrew). I then put a small snake in with him. The Shrew was very active, but seemed nearly blind, and as he ran to and fro he never seemed to be aware of the presence of anything living until he was close to it, when he would instantly spring on it like a tiger. On this occasion he attacked the little snake with great ferocity, and after an animated struggle in which the little snake whipped and rolled all around the cage, throwing the Shrew to and fro a dozen times, the latter killed and ate the snake in triumph."



From West Va. University Experiment Station

Diagram showing burrows used by Short-tailed Shrews in searching for insect food. The burrows occurred in thirty-six square-feet of ground under a chestnut tree in the woods

That they prey upon each other on occasion is also certain. Dr. Merriam once confined three of them under an ordinary tumbler. Almost immediately they commenced fighting, and in a few minutes one was slaughtered and eaten by the other two. Before night, one of these killed and ate its only surviving companion. The appetite of these Shrews is simply enormous; it is estimated that they consume twice the weight of their own bodies in twenty-four hours. The same observer states that they are fond of beechnuts, and will eat corn and oats at a pinch. "One evening not long ago," he relates, "I put a handful of beechnuts in a Shrew's water saucer. He soon found them and carried them off. Part he buried in a hole under the saucer, part under his nest, and the rest in an excavation near one corner of the box. This certainly looks as if the

animal was in the habit of hoarding for the winter."

Unlike the Long-tailed Shrews, this species is to a certain extent a digger. It burrows just beneath the surface of the ground in summer, and makes furrows in the snow in winter; and, unlike the true Mole, it spends much of its time in the open air from preference, running about over the fallen leaves of the forest or along the shaded galleries of stone walls, which it is as fond of following as is the Weasel. The result of the digging habit is probably to be seen in the size of the fore feet, which are larger and broader than the hind ones.

Of the domestic habits of the Mole Shrew we know very little, and that, in a general way, would seem to point to anything but conjugal felicity or fidelity, and their fraternal relations may safely be set down as below par. The first pairing season is probably in April, and two or three litters are produced each season. The mother builds a nest of grass and leaves in dry, underground situations, to which it resorts not only for its own shelter, but for that of its young. Four to six young compose a litter, and, as with our native Mice, the young are born at all seasons of the year, though less frequently in the winter time.

WATER SHREW

Neosorex palustris (*Richardson*)

Other Names.— Marsh Shrew, Beaver Mouse.

General Description.— Similar in many respects to Common Shrew but much larger. Nose pointed, elongate; ears inconspicuous; body moderately slender; tail quite long, nearly half total length; fore feet short; hind feet larger, adapted for swimming, having white fringes of bristle-like hair; pelage very soft.

Dental Formula.— Incisors, $\frac{4-4}{2-2}$; Canines, $\frac{1-1}{0-0}$; Premolars, $\frac{2-2}{1-1}$; Molars, $\frac{3-3}{3-3} = 32$.

Pelage.— Adults: Sexes identical, no noticeable seasonal variation. Pelage very thick and soft; above, dusky brown to very dark gray sprinkled with hoary; under parts white, silvery in some lights; the white of the under parts meeting the dark sides in a sharply defined line; tail above and at tip, seal brown; below white. Young: Similar to adults.

Measurements.— Total length, 6 inches; tail vertebrae, 2.7 inches; hind foot, .75 inch.

Range.— Minnesota to east base of the Rocky Mountains, north to 64° latitude.

Food.— Mainly insects.

Remarks.— The Water Shrews are easily distinguished from the other Shrews not only by their larger size but by the sharply contrasting color pattern of slate-gray above, white below, and by their specialized feet. There are eight species and subspecies divided into two subgenera, having for their most conspicuous superficial difference the degree of contrast between upper and lower parts, the first, or *Neosorex*, group being sharply bicolored animals; the second, or *Atophyrax* group, having under parts more like upper parts.

Related Species

Water Shrew.— *Neosorex palustris* (Richardson). Typical animal as described above. Minnesota to east base of Rocky Mountains.

Rocky Mountain Water Shrew.— *Neosorex navigator navigator* (Baird). Smaller than Common Water Shrew. Rocky Mountains and outlying ranges from British Columbia to southern Colorado, and the Sierra Nevada of California.

New England Water Shrew.— *Neosorex albibarbis* Cope. Similar to Common Water Shrew but under parts dusky. Eastern North America from Mountains of Pennsylvania and New York northward to Labrador.

Bendire Water Shrew.— *Neosorex bendirii bendirii* (Merriam). A member of the subgenus *Atophyrax;* Size large, tail long; sooty plumbeous above, paler below; tail dusky; not bicolor. Klamath Basin, Oregon, northward along east sides of Cascades to Puget Sound, westward to coast of California.

The group of Swimming Shrews have large feet, the hind ones being very long, broad, and fimbriate; the toes are all fimbriate, the third and fourth being united at the base and slightly webbed. These aquatic Shrews are of very large size, and have very long tails, and are found on the borders of streams, lakes, and marshes.

The Marsh Shrew ranges from central Minnesota to the east base of the Rocky Mountains. It is six inches in length, the tail exceeding two and one-half inches; its feet are fringed with white bristle-like hairs. Its fur is sooty brown mixed with hoary above, and the under parts are grayish white. The tail is silver white beneath and dusky above. It is a good swimmer, and has been called the Beaver Mouse by the Indians, on account of its presence in the houses of the Beaver. Little is known concerning its habits. Mr. Seton captured one in the runway of a Marsh Mouse, and he concludes that "it preys on them regularly." The captured specimen was "a female evidently suckling young."

ORDER OF BATS

(Chiroptera)

ONE of the strangest of all animals is the Bat. Partaking in its powers of flight of some of the habits of the birds, it is nevertheless a true mammal. It cannot even be regarded as a connecting link between the two kingdoms.

Bats occupy an order by themselves, which is as sharply defined as could be devised. They do not encroach upon any other order; neither do other mammals show traits belonging to the *Chiroptera*. The members of this order are true mammals with the fore limbs modified for flight. The bones of the arms and fingers are enormously elongated and drawn out; across this slender framework extends the flying membrane, a thin fold of skin, which reaches to the sides of the Bat; and from the fingers to the hind limbs on the ankle joint a cartilaginous process, the calcar, helps to support another portion of the flight membrane, which extends from ankle to ankle and envelops more or less of the tail. Peculiar modifications to further the power of flight are the rudimentary ulna, the long curved radius, the short thumb bearing a claw and long fingers with no claws, and the outwardly-directed knee joint. Other structures characteristic of Bats are the specialized ears with the peculiar upstanding process, the tragus, the thoracic mammary glands, and often accessory structures upon the nose and lips.

Bats are night-loving animals. Their flight is erratic and often swift despite the fact that their eyes are quite small. They are widely distributed over America, as well as over other countries, but, because of their secluded habits and love of darkness, few persons know much about them.

The Order is divided into two sub-orders — the *Megachiroptera*, or Fruit-eating Bats found only in the Old World; and the *Microchiroptera*, the Insect-eating Bats, of smaller size, which are found in nearly every land.

Photograph by Dr. R. W. Shufeldt

BROWN BAT WALKING

A photograph from life showing the animal's peculiar manner of walking forward on a flat surface

COMMON BROWN BAT

Eptesicus fuscus (*Beauvois*)

Other Name.— Big Brown Bat.

General Description.— A small flying mammal with leathery membrane stretched across the greatly elongated fingers and extending along sides of body to include the hind legs and tail. Head small; nostrils simple; eyes minute; ears large and broad, with a broad tragus or process on anterior part of ear conch; fore limbs elongate with fingers enormously elongated, slender, and only the thumb, which is short and rudimentary, provided with a claw; body small and muscular, especially thick through the chest; hind limbs much shorter than fore limbs, slender, with five toes, each bearing a claw, the toes of nearly equal length; tail fairly long, nearly half of total length and completely enclosed in the interfemoral membrane; flying membrane extending from the fingers to sides, to the ankle, and thence to include the tail, naked everywhere except for a few scattered hairs on back of interfemoral membrane; body covered everywhere with long soft fur of a brown color, paler below. Strictly a nocturnal mammal and insectivorous.

Dental Formula.— Incisors, $\frac{2-2}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{1-1}{2-2}$; Molars, $\frac{3-3}{3-3} = 32$.

Pelage.— Adults: Sexes identical; seasonal variation slight. Everywhere above, dark brown or sepia; underparts paler; ears and membranes blackish. Young: Rather darker than adults.

Measurements.— Total length, 4.5 inches; tail vertebrae, 1.7 inches; hind foot, .4 inch; forearm, 1.7 inches; spread of wing, 12 or 13 inches.

Range.— Greater part of the United States and adjoining British provinces.

Food.— Strictly insect-eating; mainly small forms caught on the wing.

Remarks.— There are only five subspecies of the Big Brown Bat found north of the Rio Grande. However, the Bats in general are a very large group containing many forms, some of them bearing considerable superficial resemblance to the Big Brown Bat and for this reason are listed in the related species. Most of the Bats found in the United States belong to the same family as the Big Brown Bat, and consequently the relationships are quite close between any two species.

Related Species

Common Brown Bat.— *Eptesicus* (=*Vespertilio*) *fuscus fuscus* (Beauvois). Typical animal as described

Photograph by J. H. Field

A NOON-DAY NAP

Living Bat of Common Brown species, asleep on the top of a post

above. Greater part of the United States and southern Canada.

Florida Brown Bat.— *Eptesicus fuscus osceola* Rhoads. Color more cinnamon-brown. Florida and Gulf States to Texas.

Pallid Brown Bat.— *Eptesicus fuscus pallidus* (Young). Much paler than Common Brown Bat; brownish-ashy above. Colorado.

Florida Bat.— *Dasypterus floridanus* Miller. Appearance much like that of Common Brown Bat but interfemoral membrane furred on dorsal half; color light yellowish-brown. Florida and Gulf Coast west to Louisiana.

Rafinesque's Bat.— *Nycticeius humeralis* (Rafinesque). Smaller than Common Brown Bat, with tip of tail free of the membrane; umber-brown above. Eastern United States west to Arkansas and southern Texas.

Big-eared Bat, or Lump-nosed Bat.— *Corynorhinus macrotis macrotis* (LeConte). Size about that of Common Brown Bat; ears enormous, 1.25 inches high, joined at base; a thick club-shaped enlargement between eyes and nostrils; yellowish-brown above, grayish-white below. Eastern United States in southern portion.

Spotted Bat, or Jackass Bat.— *Euderma maculatum* (Allen). Ears even larger than those of Big-eared Bat, about 1.5 inches high by nearly an inch wide; nose without any excrescences; color peculiar in being distinctly spotted, a white spot on each shoulder and one on rump, and whitish areas at base of ears and upper sides of neck; fur elsewhere above dark sepia; below fur black at base, white at tips; size about that of Common Brown Bat. Scattered localities in the Southwest; California, New Mexico and Arizona.

Pale Bat.— *Antrozous pallidus pallidus* (LeConte). Size that of Common Brown Bat; ears large; tragus tall, slender, straight; drab-gray above, grayish-white below. Desert region of eastern California, Nevada, Arizona, New Mexico and western Texas.

Silvery-haired Bat.— *Lasionycteris noctivagans* (LeConte). Somewhat smaller than Common Brown Bat but general proportions much the same. Has 4 premolars, but otherwise the dental formula is the same. Head small; ears short, not so broad as long; tragus short and straight, rounded at tip; body small; wings large; hind feet slender; interfemoral membrane extensive, furred for about half its width above; tail fairly long but less than half total length; general color sooty brown with the hairs silver-tipped. Total length, 4 inches. A common Bat in many regions.

Little Brown Bat.— *Myotis lucifugus lucifugus* (LeConte). See special synopsis.

Least Brown Bat.— *Pipistrellus hesperus hesperus* (H. Allen). See special synopsis.

Red Bat.— *Lasiurus borealis borealis* (Müller). See special synopsis.

One of the strangest of all animals is the Bat. A true mammal, it yet has habits in common with the birds; while among the different species the variety of forms it exhibits is fairly bewildering. All over the world they are found, the total number of species being about 1200; but a large proportion of these are known only by their skins or skeletons in some museum.

The largest Bats are found in the tropics. The United States, being in a temperate zone, contains only a few of the smaller species. All Bats living in the colder regions must either hibernate in winter, or migrate.

The lack of common knowledge about Bats is remarkable. Many persons fear them, although our native Bats are weak and harmless. The great majority of Bats are useful to man in destroying bugs and insects. The more dangerous species, such as blood-suckers, or Vampires, inhabit the tropics. "To be 'as blind as a Bat' is not to be blind at all," says Hornaday, "but rather to possess powers of vision that are uncommonly good in semi-darkness, or at night, and fairly good even in the broad light of day. When disturbed at midday, all the Bats I have seen alive (perhaps twenty species in all) have flown away to places of security as briskly and successfully as so many swallows. The eyes of all night-flying Bats are small, jet black, and look like tiny black beads, but those of the day-flying Fruit-Bats are very much larger in proportion."

As previously remarked, very little is known regarding the habits of the Bats, chiefly because their nocturnal habits make it very difficult to find them, or to observe them. We know that in winter some of our species live in caves, in a semi-dormant condition. Dr. C. H. Eigenmann says, of the thousands that inhabit Mammoth Cave, "they fly readily if disturbed in the summer, but in winter they hang apparently dead. If disturbed, a few respiratory movements may be seen, and they may utter a few squeaks, when they again remain apparently lifeless. If knocked from the roof some of them fall to the bottom of the cave and flap about, others fly away. I have seen them leave a cave in midwinter, after being disturbed, but fly no further than a hundred yards, then turn and enter the cave again."

In central Montana, where there are no trees, a large colony of Bats inhabit a cave that a subterranean stream had washed under the prairie. In Arizona there is a cave which is said to contain "a million" Bats. "Once while hunting Elephants in the Malay Peninsula," says Hornaday, "the attention of my companion and myself was arrested by a strange, pungent odor

which filled the air. Upon investigating the cause of it, we discovered a large cave of a very interesting character, inhabited by thousands of Bats, and floored with a layer of Bat guano a foot or more in depth, representing the accumulation of a century."

In the warm countries, Bats inhabit hollow trees. But it is questionable whether they inhabit such homes and actually hibernate in them in winter, in the temperate zone, or migrate. Dr. C. Hart Merriam has proved that some Bats of the North American temperate zone do migrate, as birds do, going south in winter and returning in spring.

From their swift flight through the air, we might think that Bats had wings like birds, but birds have feathers, while Bats are covered with soft fur. Their wings are not like those of a bird, but consist of a tough, leather-like membrane, or skin, which extends from the sides of the body to the ends of the feet.

The legs are very slender. The hind feet are provided with claws, and from the extremity of the fore legs or hands are four long, bony fingers that pass through the membrane which forms the wings, and support it. At the top of the wing is the thumb, with a sharp claw that is a very useful hook. Bats can fold their wings by drawing them close to their body as one would close an umbrella. When they rest or sleep, these odd creatures hang head downward, holding to their perch by means of the claws of their hind feet.

Bat's wings seem to have a delicate nervous organism, which enables them to feel that they are approaching an object before they have actually touched it, and then they quickly alter their course and fly in another direction. They depend more upon their sense of feeling than upon sight, and this explains why a Bat which has almost touched an object will suddenly wheel away to avoid contact.

The Bat's flight, while seemingly aimless, is actually purposeful; for it is while flying that the Bat gets his food. He feeds wholly upon insects, chiefly those that fly by night, and at every sudden turn we see him make, we may assume that he has captured an insect.

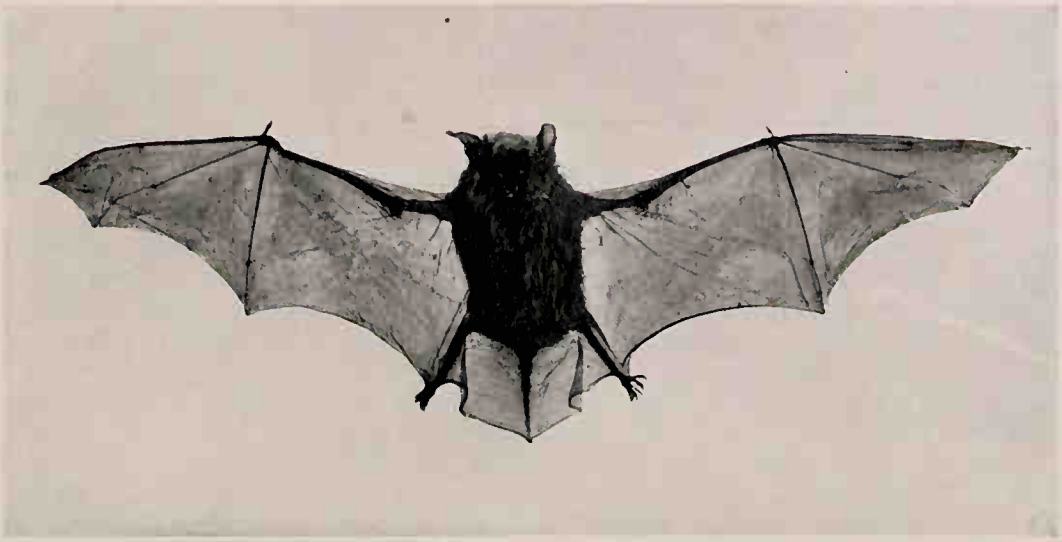
The Big Brown Bat, which is called also the Carolina Bat, House Bat, and Serotine Bat, is one of the commonest Bats in the Middle States, but is also found in other states from Oregon to Maine, as far north as Lake Winnipeg, and southward to Central America. It is nearly five inches long, with a wing expanse of twelve inches or a little over. Its ears are of medium length and slightly pointed. Its fur, which is silky in texture, is dark brown above and somewhat lighter below.

Brown Bats make their appearance late in the evening; they fly lower than the Red Bats; and they may always be distinguished by their great size. They have enormous appetites, and drink a good deal. Dr. R. W. Shufeldt is authority for the statement that one specimen, in the course of a single night, consumed twenty-one full-grown June bugs, leaving only a few legs and the hard outside wing-sheaths. Nothing is known concerning the breeding of this Bat. Of its habits, Stone and Cram write: "The large Brown Bat is seen late in autumn and on mild evenings in mid-winter, and they not infrequently fly into houses during the latter season and seek temporary shelter, only to sally forth again the next night to the terror of certain of the occupants of the bedrooms, causing an excitement that could scarcely be surpassed were they the famous Vampires of the tropics. In summer-time they still more frequently enter houses in the evening in pursuit of flies and other insects which are attracted by the lights, and pass back and forth wheeling and twisting with the utmost dexterity, and always avoiding objects which may stand in their path. Since the introduction of electric lights along the streets of Philadelphia, the Bats are frequently to be seen flying about in their radiance, reaping a rich harvest of their favorite food."

Rhoads, in "Mammals of Pennsylvania," has this to say of the Big Brown Bat: "Among American Bats this species may be said to correspond in its fondness for the homes of man to the Mouse and Rat, or to the robin and the wren among birds. During summer, they are as likely to hang up for day-dreams behind an unused shutter or door, or a crack in the wall, or a shady porch or out-house, as anywhere else. This Bat is accused of bringing bed-bugs and other insect vermin into houses. I have never found any vermin on them except lice of a species not parasitic on man."

Jaws of this Bat have been found among other bones in pellets under the nest of the great horned owl, in southwestern Texas; and in British Columbia rainbow trout have been seen to leap after the Bats as they skimmed the surface of a lake in the evening. The species is supposed to be migratory.

The *Spotted*, or *Jackass Bat* is of very unusual appearance, having enormous ears like the proverbial jackass. It is exceedingly rare, being known from a single specimen only, which is in the American Museum of Natural History in New York. It differs so widely from others that no comparison with any is necessary. Its peculiar color at first suggests albinism, but since the fur is everywhere dark at base, even in the white areas, the pattern is probably normal. Dr. Merriam says of the Spotted Bat: "The type of this remarkable genus and species is believed to have been obtained near San Fernando, Cal. The type specimen remains the only one thus far collected, but the species probably ranges over much of the lower Sonoran Desert region in summer. While in Vegas Valley, Nev., I was told that a very large Bat 'with ears like a jackass and a white stripe on each shoulder' is abundant at that place in the summer, but does not occur in spring or fall." It is probably a migrating species.



Photograph from the American Museum of Natural History

COMMON BROWN BAT

A mounted specimen, showing the enormous wing spread. It is next to impossible to obtain such a picture of the living animal, because of its erratic flight and also because it flies by night

LITTLE BROWN BAT

Myotis lucifugus (*LeConte*)

General Description.— Similar in superficial characters to the Common Brown Bat, but much smaller. Head small; ears more slender and proportionately taller, tragus slender; body small; wings long and narrow; tail quite long but less than half total length; pelage soft, dull-brown in color; membranes not furred except at extreme base of interfemoral membrane. The commonest small Bat of North America.

Dental Formula.— Incisors, $\frac{2-2}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{3-3}{3-3}$; Molars, $\frac{3-3}{3-3} = 38$.

Pelage.— Adults: Sexes identical; seasonal variation slight. General color somewhat variable in shade but usually dull brown; beneath pale brown tinged with gray or yellowish; membranes blackish. Young: Similar to adults.

Measurements.— Total length, 3.6 inches; tail vertebrae, 1.4 inches; hind foot, .4 inch; expanse of wings, 9 inches.

Range.— Whole of North America north of the Rio Grande, except in the Rocky Mountains and on the Pacific Coast.

Food.— Insects.

Remarks.— The Little Brown Bat is a member of a genus that has become differentiated into a great many species and subspecies, all, however, showing their

relationship by their general similarity to one another. Some 21 species and subspecies are known north of the Rio Grande.

Related Species

Little Brown Bat.—*Myotis lucifugus lucifugus* (LeConte). Typical animal of the above description. Nearly whole of North America.

Large-eared Little Brown Bat.—*Myotis velifer* (Allen). Ears long; size large for the genus; fur dull sepia throughout, paler on belly; total length, 4 inches. Southern United States into Mexico.

California Little Brown Bat.—*Myotis californicus californicus* (Audubon and Bachman). Size very small; total length, 3.15 inches; yellowish-brown above, paler below. Western United States east to Wyoming and Texas.

Pallid Little Brown Bat.—*Myotis californicus pallidus* Stephens. Size small; ears small; above, light ochraceous-buff; below, dull-white. Arid regions of southern California.

Say's Little Brown Bat.—*Myotis subulatus subulatus* (Say). Similar to Little Brown Bat but ears longer and tragus more sharply pointed. North America east of the Rocky Mountains.

The Little Brown Bat is one of the commonest of our small visitors, yet the popular misconception of its appearance and habits is astonishing. Probably forty out of every fifty persons to whom the head of a Little Brown Bat was shown would be unable to name the animal to which it belonged; a few might say it belonged to some kind of Mouse. How many of us know that these little denizens of twilight-land have fingers and thumbs so long that, were a man's built on the same scale, the human fingers would be four feet in length? And what fear one of these little creatures brings upon persons who, at least, ought to know that Bats are not only among the least harmful of animals, but, by their consumption of insects, are really to be classed among man's benefactors.

A typical incident will illustrate the consternation caused by one of these unexpected winged callers. It was in the dusk of a warm September evening. Most of the family were on the piazza, but the daughter of the house was playing the piano in the parlor. Suddenly the music ceased, and a shriek from the performer brought the party from the porch in haste, to discover that a Little Brown Bat, attracted — who knows? — by the strains of Chopin, or, more probably, chasing some insect for supper, had entered the house and was circling round the parlor. Instantly there was commotion and, among the ladies, consternation. The colored butler was hastily summoned to eject the unwelcome intruder, but neither he nor his wife could be persuaded to approach it. After considerable "shooing," the Bat was driven from the room and peace was restored.

The Little Brown Bat is one of the smallest of American Bats, measuring but three or three and one-half inches from snout to tail-tip, and having a spread across the wings of nine inches. Its eyes, which are nearly hidden in its fur, are small and beadlike; and its ears are short and pointed, barely reaching, when thrust forward, to the tip of the nose. Its fur is dark glossy brown above; below, the color is paler and more yellowish. Save for a small strip near the body, the membranes of the wings, as also that of the tail, are quite naked. This Bat can always be distinguished in the air by its eccentric flight.

Little is known of the Little Brown Bat's mating habits. It, in common with all American Bats, does not make any nest. There are usually two young at a birth, and these, according to Rhoads, "cling by their mouths to the teats of the mother until large enough to grasp her body. Thus laden, she pursues her nightly avocations until they can be left 'hung up' in some secret place till her return." Until about three months old the young Bats remain at home and are fed by the mother. The father does not seem to trouble himself much about the welfare of his offspring.

Like the rest of the family, this Bat spends the daylight in caves, or, if it cannot find these, in ruins, hollow trees, and even garrets. In certain parts of Texas, Bats have frequented caverns in such numbers that they have created valuable deposits of guano. It hibernates, at any rate for a season, during frosty weather; and it seems to take advantage of the later warm days to migrate southwards, since it is not known to torpify for all winter.

LEAST BROWN BAT

Pipistrellus hesperus (*H. Allen*)

General Description.— Smallest of the North American Bats. Head small; ears short, tapering to a narrow rounded tip and longer than broad; tragus rather short, very blunt and curved forward; body small; feet small; interfemoral membrane of moderate size, sparsely haired on upper surface next to body; face and ears bare, black; pelage, pale drab. A swift-flying, delicately built Bat.

Dental Formula.— Incisors, $\frac{2-2}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{2-2}{2-2}$; Molars, $\frac{3-3}{3-3} = 34$.

Pelage.—Adults: Sexes identical; seasonal variation slight. Above, pale drab; below, brownish-white; all the fur blackish at base; membranes, dull black. Young: Similar to adults.

Measurements.— Total length, 2.8 inches; tail vertebrae, 1.2 inches; ear from crown, .4 inch; expanse of wing, 7.9 inches.

Range.— Western United States from Texas to the Pacific Coast.

Food.— Insects of flying varieties.

Related Species

Least Brown Bat.— *Pipistrellus hesperus hesperus* (H. Allen). Typical animal of the above description. Western United States.

Georgian Bat.— *Pipistrellus subflavus subflavus* (F. Cuvier). Larger than *hesperus;* general color, yellowish-brown. Eastern United States, west to Iowa and southern Texas.

Dusky Least Bat.— *Pipistrellus subflavus obscurus* Miller. Color duller and less yellow than that of Georgian Bat; pale wood-brown above. Central and eastern New York.

The Least Brown Bat deserves special attention because of its diminutive and graceful appearance. It is the smallest of our native Bats, and approaches the Pygmy Shrew in the distinction of being one of our smallest mammals of whatever order. Its body, not measuring the tail, is only about one and one-half inches long. But on account of its expanse of wing — nearly eight inches — this small size of body is not appreciated. This Bat has the delicate mechanism of a watch. It is quick, nervous, alert, and agile. It appears to be among the brightest in mental development. While closely related to the little Brown Bats, the Least Brown Bat is even more delicate. It may be readily told from members of the genus *Myotis* by the shape of the ear and the extent of furring of the interfemoral membrane as well as by its size. Three species of this genus are found north of the Rio Grande.

RED BAT

Lasiurus borealis (*Müller*)

General Description.— About the size of the Common Brown Bat but coloration strikingly different. Head small; nostrils simple; ears broad, rounded at tip, hairy; tragus roughly triangular in outline; body small; wings large; tail long, nearly half of total length and completely included in interfemoral membrane, which is covered with fur on upper surface; general color bright reddish-brown. A common Bat in the eastern United States.

Dental Formula.— Incisors, $\frac{1-1}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{2-2}{2-2}$; Molars, $\frac{3-3}{3-3} = 32$.

Pelage.—Adults: Sexes identical; no noticeable seasonal variation. Color variable but ranging from bright reddish-brown to yellowish-red or yellowish; a small whitish patch in front of shoulder; pelage long and soft. Young: Similar to adults, but not as bright until nearing maturity.

Measurements.— Total length, 4.2 inches; tail vertebrae, 2 inches; hind foot, .3 inch; wing expanse, 12 inches.

Range.— Eastern North America from Canada to Florida, and Texas west to Colorado.

Food.— Insects.

Remarks.— This strikingly-colored Bat may be known at once from all the other Bats by its peculiar markings; and all the members of the genus may be told by the furred interfemoral membrane. There are four species and subspecies of this genus found north of the Rio Grande.

Related Species

Red Bat.— *Lasiurus borealis borealis* (Müller). Typical animal of the above description. Eastern North America south to Florida, west to Colorado.

Florida Red Rat.— *Lasiurus borealis seminolus* (Rhoads). Similar to Red Rat but general color mahogany-brown. South Carolina to southern Texas.

Western Red Bat.— *Lasiurus borealis teliotis* (H. Allen). Smaller than Red Bat with shorter ears. California.

Hoary Bat.— *Lasiurus cinereus* (Beauvois). See special synopsis.

Photograph by American Museum of Natural History

A TROPICAL LEAF-NOSED BAT

A mounted specimen showing breadth of wings and smallness of body. A beautiful animal in flight, its brilliant color vying with that of the birds

One of the most beautiful of creatures, vying in brilliance with the birds themselves, is the Red Bat of our Eastern and Southern States. Its name indicates its distinguishing color, a bright reddish brown, paling to yellow. Another mark is its broad, rounded, hair-tipped ears.

Mr. Seton gives this Bat the additional name of "Tree Bat," and says: "The Red Bat is, above all its kin in our country, a tree Bat. In winter it is known to gather in vast numbers in the caves of its more southerly range. As far as these facts go, they point to a migration from the northern part of its range and a hibernation in the southern part." Mr. Witmer Stone adds: "Where dark caves are to be found, these Bats congregate there in immense numbers during the daytime, but in most localities they frequent lofts and garrets which offer them suitable shelter."

The Red Bat is the first to make its appearance in the evenings, even while it is still light, and it often enters houses while hunting its insect prey. In the daytime it may be seen in a variety of places — lofts and garrets, chimneys, and behind shutters. Near Millerton, New York, an observer noticed eight Red Bats that hung up for the day behind the shutters to one of the windows of his bedroom. They did this during the greater part of a fortnight.

Red Bats are great devourers of insects; and it cannot be doubted that among the latter there must be consumed a large number of disease-carriers. Recognizing this fact, the city of San Antonio, Texas, protects Bats by law. Dr. C. A. Campbell, a resident, believes "that the Bat properly protected and developed, in vast numbers, will practically rid the world of malaria." Being of this same opinion, the San Antonio municipal authorities have caused to be erected in that city the first Bat-roost, which is depicted in the *Houston Chronicle* of March 17, 1915. It is a tower-like structure, with openings to admit the Bats, and bears the sign "Municipal Bat-roost."

Nothing is known of the mating habits of the Red Bat, but it is probable that the breeding season is October, as very young Bats have been found in May and early June. The usual number of young is probably four. On June 18, 1902, an adult female Red Bat was brought alive into the National Museum at Washington, D. C., with a young one at each of her nipples, where it held on with great tenacity, having in its mouth a good deal of its mother's hair, into which its hooked milk teeth firmly caught. Three of the young Bats were females and one was a male, and the combined weight of the four was 12.7 grammes, the mother's weight being but 11 grammes. How she was able to sustain such a weight in her nightly flights is one of the secrets of Bat life.

HOARY BAT

Lasiurus cinereus (*Beauvois*)

General Description.— One of the largest North American Bats. General characters of the Red Bat, but coloration much different. A beautiful Bat of striking appearance.

Dental Formula.— Same as Red Bat.

Pelage.— Sexes identical; no seasonal variation. Upper pelage blackish at base, the middle of the hairs pale yellowish-brown, the tips distinctly hoary-white; head ochraceous; breast and much of belly similar to the back; remainder of lower parts grayish-buff; fur on underside from elbow to wrist.

Measurements.— Total length, 5.5 inches; expanse of wings, 16 inches.

Range.— Boreal North America from the Atlantic to the Pacific.

Food.— Insects.

Remarks.— Color variation is considerable, but never enough to obscure the character of the species. It appears to be wholly independent of locality, as skins from such widely separated localities as Minnesota and southern California are found to be extremely hard to distinguish apart.

Among the "Winged Brownies of the Woods," as Mr. Seton calls them, one of the notables is the Hoary Bat, sometimes termed the Great Northern Bat. He does not come abroad of evenings with the common Bat herd; not until "the twilight is fast fading into night, and your eyes fairly ache from the constant effort of searching its obscurity," does this rare animal appear in Shadowland. Nor is he one of the numerous low-flying crowd; "far above the tree-tops of the forest where fly the great luna moths and the cecropias, with others half as big

By permission of the American Museum of Natural History — Photograph by G. Clyde Fisher

RED BAT

This picture was taken in Delaware, N. J., the animal hanging from a twig, asleep

as itself and worthy of its powers," will you see this rarest of all the Eastern species of Bats, or darting downward, to drink of a neighboring brook, and again shooting up with lightning speed.

The Hoary Bat is perhaps the largest of all the Bats of the Northern and Middle States. It is much larger than the Red Bat, being from five to five and one-half inches in length, and having a wing spread of fifteen to seventeen inches. Its ears are broader in proportion to their length than those of the Red Bat.

The range of the Hoary Bat is as wide as the continent. Specimens have been found in at least eighteen States; also in Canada and Mexico. As to its local range, Dr. Merriam says: "Its nightly range is vastly greater than that of any of its associates. While the other species are extremely local, moving to and fro over a very restricted area, this traverses a comparatively large extent of territory in its evening excursions, which fact is probably attributable to its superior powers of flight."

According to Miller, the Hoary Bat breeds within the Boreal zone; and Merriam thinks "there can be no reasonable doubt" that the mating time is about the first of August. In 1883, between July 30 and August 6, he saw more Hoary Bats than he has "seen in all before and since, and twelve adult specimens killed during that brief period were all males. They were not feeding, but were rushing wildly about, evidently in search of the females." The young are born in late May or early June, the usual number being four. During June and July the young Bats grow quickly. The mother leaves them in the den or lurking-place, often a knothole in a hollow tree, screened from hawk or marten, and too small to admit those enemies of the Bat tribe. The mother Bat strips the bodies of moths and other insects of their limbs and hard casings and brings the soft parts to her young ones. One meal at evening twilight and another at morning twilight is the order of feeding in Bat circles. The young Bats soon learn to fly and are taken out nightly by their mother. The Hoary Bat is very particular about its toilet, cleaning its fur like a cat.

Among the enemies of the Hoary Bat must be listed, besides such four-footed ones as the marten, the blue jay, horned owl, and hawk.

Like its red cousin, the Hoary Bat is migratory. This fact is attested by observations in Canada, by those of Dr. E. A. Mearns in the Hudson Highlands of New York, where, during the first week of November or a little earlier, great flights of them have been seen, and by those of S. N. Rhoads, who has "observed this species returning apparently from extensive flights over the ocean on the New Jersey coast in the early morning before sunrise." Miller, too, in August and September, saw the appearance and disappearance of three species of Bats, among which was the Hoary Bat, at Highland Light, Cape Cod, Massachusetts. As with the Red Bat, in migrating the males fly in one flock and the females in another.

LITTLE FREE-TAILED BAT

Nyctinomus cynocephalus (*LeConte*)

General Description.— A small, dark-colored Bat with the tail partly free of the usual interfemoral membrane. Head small; muzzle blunt, with thick upper lip; long bristles on face; ears broad and almost meeting at their inner margins; body small; wings narrow; long hairs on back of all the toes; pelage rather shorter and more velvety than that of other Bats.

Dental Formula.— Incisors, $\frac{1-1}{3-3}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{2-2}{2-2}$; Molars, $\frac{3-3}{3-3}=32$.

Pelage.— Adults: Sexes identical, seasonal variation slight. Above, and on sides of neck, dusky-brown or plumbeous; under parts and sides paler; hairs of upper parts and sides of neck white at the base; elsewhere unicolor. Young: Similar to adults but blacker.

Measurements.— Total length, 3.5 inches; tail vertebrae, 1.2 inches; hind foot, .3 inch.

Range.— Southern United States.

Food.— Insects.

Related Species

Little Free-tailed Bat.— *Nyctinomus cynocephalus* (LeConte). Typical animal as described above. Southern United States.

Mohave Bat.— *Nyctinomus mexicanus* (Saussure). Color sooty-gray, below smoke-gray. About the same size and with markings of the Free-tailed Bat. Arizona and California.

California Mastiff Bat.— *Eumops californicus* (Merriam). Size very large; total length, 6.4 inches; ears united at base and very broad; a glandular swelling in front of each eye; sooty-brown, paler below. Southern California.

The Little Free-tailed Bat is a typical member of the family, and is perhaps more numerous in the southern United States than others. It is a small, dark-colored Bat with several strong marks of identification, such as the tail free for nearly half its length from the membrane that envelops the entire tails of other Bat families. Besides this it has bristles on its face, as though it were sadly in need of a shave; and its fur has a softer feel than usual. Its dark color and velvety pelage are also good characters for identification. Its nearest relatives are other Bats, free-tailed like itself and belonging to the family *Molossidae*. Of this group only five or six venture further north than the Rio Grande.

It is a sociable animal, almost always being found in large colonies, when present at all. It ventures forth early in the evening, evidently following the motto that the early Bat catches the insect. It flies quickly and unerringly, and seems to see pretty well in almost any sort of light verging from the failing light of sundown to total darkness.

Another member of this family which deserves notice is the California Mastiff Bat, one of the largest of all Bats found in North America. It is over six inches long, including the tail; and when its wings are spread out in flight it presents an imposing appearance. It is found in Southern California.

CALIFORNIA LARGE-EARED BAT

Macrotis californicus *Baird*

Other Name.— California Leaf-nosed Bat.

General Description.—A medium-sized Bat with tall, broad ears. Head small; nostrils simple; nose contains an erect, simple "leaf" of cartilage and skin; ears very large, connected at bases; tragus slender, pointed; wings broad, not furred; body of normal proportions; interfemoral membrane small, concave in outline; tail extending beyond interfemoral membrane and nearly one-half the total length.

Dental Formula.— Incisors, $\frac{2-2}{2-2}$; Canines, $\frac{1-1}{1-1}$; Premolars, $\frac{2-2}{3-3}$; Molars, $\frac{3-3}{3-3}=32$.

Pelage.—ADULTS: Sexes identical, no noticeable seasonal variation. Above, grayish-brown; below lighter; base of fur white; membranes light-brown; pelage soft. YOUNG: Color and markings similar to adults.

Measurements.— Total length, 3.7 inches; tail vertebrae, 1.6 inches; ear from crown, 1.1 inches; hind foot, .4 inch; expanse of wing, 13 inches.

Range.—Arid region of southwestern United States.

Food.— Insects.

Remarks.— This Bat is the sole North American representative of the family of so-called Leaf-nosed Bats, the members of which are characterized by the possession of a more or less modified cutaneous nose-leaf. Other members of this group range south of the United States.

The California Large-eared, or Leaf-nosed Bat is the only member of this family of Bats found habitually north of the Rio Grande. There are other members of this peculiarly-marked group found in the topics. It seems to prefer hot or arid lands, for its home in North America is the desert region in the southwest.

The distinguishing mark on the end of the nose can be readily recognized. It seems to be made up of thin leaves of naked skin. These appendages have various shapes, as of a wedge, spear, or heart. Sometimes they are comparatively small, and sometimes they are so large that they form a kind of mask. In one instance, that of De Blainville's Bat, a West Indian species, the chin also has a convoluted extension of skin, giving the animal a weird and uncanny expression, not unlike a huge rosette or double-flower; hence it is termed a "Flower-nosed Bat."

There seems now to be little doubt that these nose-leaves are in some way connected with that "sixth sense" the possession of which by certain Bats has been often demonstrated, and which enables them to avoid all obstructions when flying in total darkness, and even when their eyes have been sealed.

The California Large-eared Bat has one of the simplest forms of nose-leaf, with defined lower border. It is a medium-sized Bat with large ears which are united above and between the eyes by a membrane. The lower lip is grooved, and there is a small wart on each side of the groove.

"I once kept a Large-eared Bat as a pet," says one observer, "and a most interesting little

creature he was. One of his wings had been injured by the person who caught him, so that he could not fly, and was obliged to live on the floor of his cage. Yet, although he could take no exercise, he used to eat no less than seventy large bluebottle flies every evening. As long as the daylight lasted, he would take no notice of the flies at all. They might crawl about all over him, but still he would never move. But soon after sunset, when the flies began to get sleepy, the Bat would wake up. Fixing his eyes on the nearest fly, he would begin to creep toward it so slowly that it was almost impossible to see that he was moving. By degrees he would get within a few inches. Then, quite suddenly, he would leap upon it, and cover it with his wings, pressing them down on either side of his body so as to form a kind of a tent. Next he would tuck down his head, catch the fly in his mouth, and crunch it up. Then he would creep on toward another victim, always leaving the legs and the wings behind him, which in some strange way he had managed to strip off, just as we strip the legs from shrimps.

"I often watched him, too, when he was drinking. As he was so crippled, I used to pour a few drops of water on the floor of his cage, and when he felt thirsty he would scoop up a little in his lower jaw, and then throw his head back in order to let it run down his throat. But in a state of freedom Bats drink by just dipping the lower jaw into the water as they skim along close to the surface of a pond or a stream, and you may often see them doing so on a warm summer's evening. They get both food and drink on the run."

Photograph by Dr. R. W. Shufeldt

BROWN BAT ASLEEP

These Bats sleep head downward, hanging by their feet and " hooks "

GLOSSARY

(For the scientific names of the orders, suborders, and families of mammals, consult the Index.)

Abdominal. Relating to the abdomen or belly.

Abnormal. Irregular; not conforming to the type.

Alpine. Pertaining to high altitudes, chiefly near timber line.

Annulated. Surrounded by rings of color.

Aquatic. Pertaining to or living in the water.

Arboreal. Pertaining to or living in trees.

Bicolor. Of two colors.

Boreal. Northern; used by scientists to designate a division of the earth comprised of its northern and mountainous parts.

Canine. The conical tooth next to the incisors. It is wanting in rodents.

Carnassial tooth. One of the last pair of premolar teeth in the upper jaw; one of the first pair of true molars in the lower jaw.

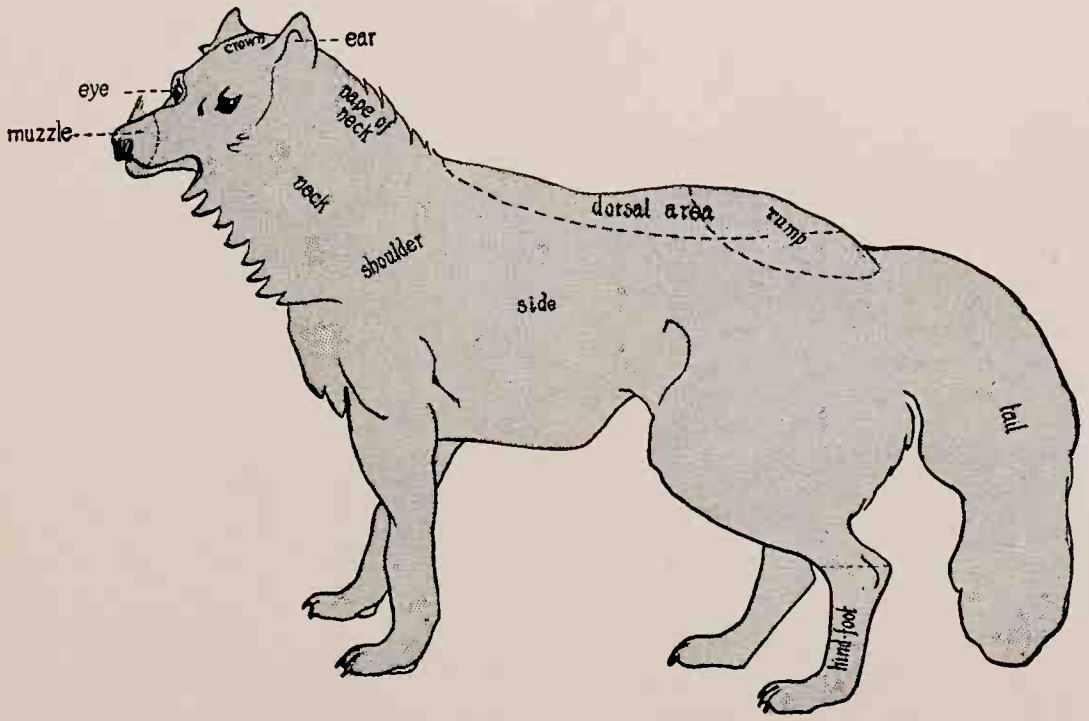
Deciduous. Shed at certain periods or seasons.

Dental. Relating to the teeth. Dental formula is a method for showing the number and kind of teeth. The numbers in each jaw are written like fractions; those above the line representing the teeth in the upper jaw, and those below the line the teeth in the lower jaw. The number of teeth on each side of the jaw is shown by means of a dash separating the figures. The dental formula of the ocelot, for instance, is given thus:

Incisors, $\frac{3-3}{3-3}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{3-3}{2-2}$; molars, $\frac{1-1}{1-1}$; total, 30.

Dichromatic. Having two phases of color, independently of age, sex, or season.

Digitigrade. Walking upon the toes (as all birds and most mammals).



ANATOMICAL DIAGRAM OF THE WOLF

Carnivore. A flesh-eating animal, particularly one of the order Carnivora.

Carnivorous. Flesh-eating; feeding or preying on other animals.

Clavicle. The collar bone.

Comatose. Drowsy; denoting a state of profound sleep from which it is difficult to awaken one.

Crepuscular. Active at twilight.

Crustacean. One of the Crustacea, a class of animals including the crabs, lobsters, barnacles, etc.

Diurnal. Active in the daytime.

Dorsal. Situated on or near the back; pertaining to the back.

Elongate. Used in the sense of lengthened or extended; elongated.

Embryo. Unhatched or unborn young in the early stages of development.

Environment. The external conditions and influences affecting the life and development of an animal.

Erectile. Capable of being erected or dilated.

Exotic. Foreign; not native; introduced from a foreign country.

Family. A group of genera agreeing in certain characters, and differing in one or more characters from other families of the order to which they belong.

Fauna. The animal life of a region.

Ferruginous. Like iron rust in color; yellowish red; brownish red.

Fetus. Unborn young in the later stages. Spelled also fœtus.

Fissiped. Cloven-footed; having the toes separated to the base.

Fossorial. Inhabiting burrows; adapted for digging or burrowing.

Frugivorous. Feeding on fruit.

Fulvous. Tawny; dull yellowish with a mixture of brown and gray.

Genus [plural, **genera**]. A group of species agreeing in certain characters, and differing from other genera of the family to which they belong; also a single species showing unusual differences.

Graminivorous. Feeding on grass and similar food.

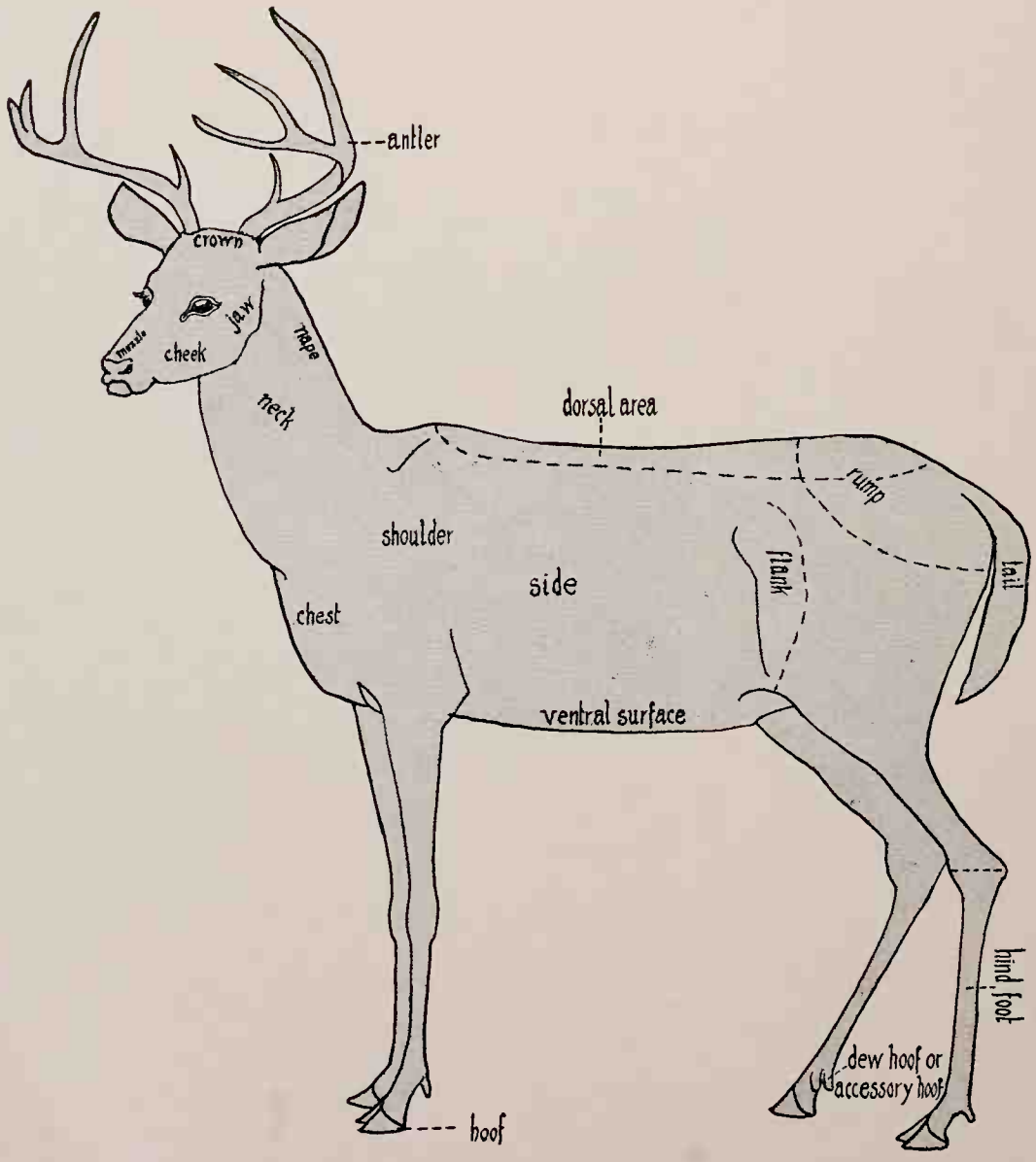
Granivorous. Feeding on grain or seeds.

Gregarious. Living or going in flocks or herds.

Habitat. Natural abode of an animal; the kind of environment in which an animal occurs.

Herbivorous. Living on or eating plants.

Heterogeneous. Of unlike qualities; differing in kind.



ANATOMICAL DIAGRAM OF THE ELK

Hibernate. To pass the winter in a lethargic or torpid state.

Homogeneous. Of like nature or kind.

Humerus. The bone of the upper part of the fore limb, from shoulder to elbow.

Hybrid. Offspring of parents of different species. Resulting from the union of two races or species.

Incisor. A cutting tooth in front of the canines, or a corresponding tooth of the lower jaw.

Indigenous. Growing or living naturally in a country or region; native; not imported.

Insectivorous. Feeding on insects; of or pertaining to insects.

Interfemoral. Between the thighs. In bats the interfemoral membrane is the membrane connecting the hind legs.

Littoral. Pertaining to or inhabiting the shore. A coastal region.

Longitudinal. Placed or running lengthwise.

Monogamous. Mating with only one of the opposite sex. Compare polygamous.

Nocturnal. Moving about at night; done or occurring in the night.

Nonretractile. Not capable of being drawn in or back.

Occiput. The back part of the head.

Ochraceous. Of the color of ocher; resembling ocher.

Olivaceous. Olive-colored; of an olive-green color; resembling the olive.

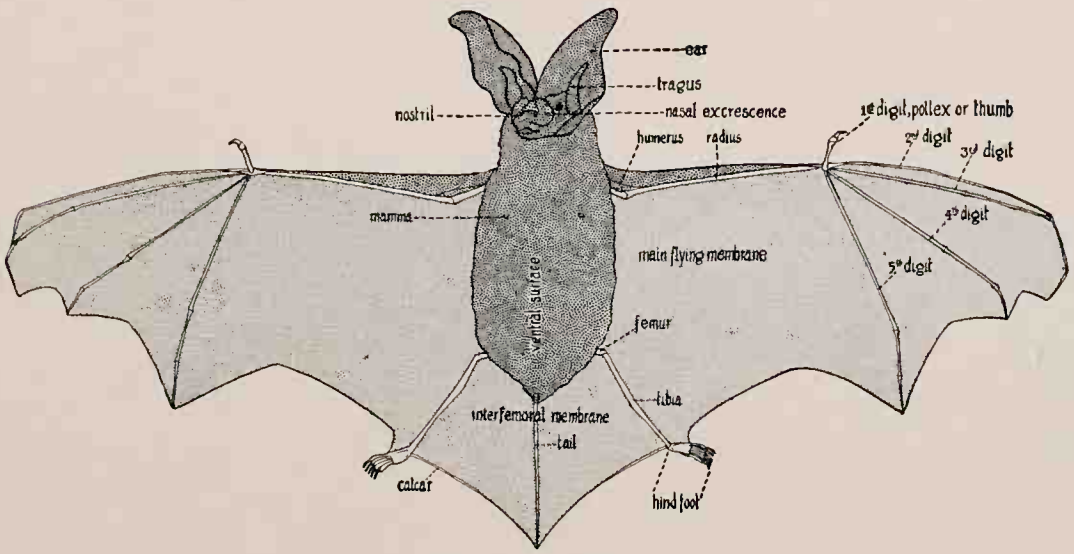
Omnivorous. Eating both vegetable and animal food.

Order. A group of families agreeing in certain characters.

Palmated. Handshaped; like a hand with its fingers spread. In birds, having the forward toes webbed.

Pelage. A coat or covering, as of hair, fur, or wool.

Pelagic. Oceanic; living at the surface of the sea far from the coast.



ANATOMICAL DIAGRAM OF THE BAT

Maculate. Spotted; blotched.

Mamma [plural, **mammæ**]. A glandular organ in which the milk is secreted. It is present in all mammals, but in males is usually rudimentary. This word is sometimes loosely used for teat.

Mammal. An animal the female of which suckles her young.

Marine. Pertaining to, existing in, or formed by the sea.

Maritime. Living or found near the sea; bordering on the sea.

Marsupial. Having a pouch in which the young are carried. One of the order Marsupialia.

Metatarsal. Pertaining to the metatarsus or the part of the foot between the ankle and the toes.

Migratory. Moving, either occasionally or regularly, from one climate or region to another.

Molar. Grinding. A molar tooth, one of the cheek teeth behind the incisors and canines.

Mollusks. Shellfish such as clams, oysters, whelks, etc.

Pendulous. Hanging downward; suspended loosely; swinging.

Phylum. A subkingdom or branch of the animal kingdom.

Piscivorous. Feeding on fish.

Plantigrade. Walking on the full length of the foot, as man and the bears. A plantigrade animal.

Polygamous. Having more than one mate at one time. Compare monogamous.

Prehensile. Adapted for seizing or grasping, as a monkey's tail.

Premolar. Preceding or in front of the true molar teeth. A premolar tooth.

Radial. In the region of or pertaining to the radius.

Radius. The front one of the two bones of the forearm.

Retractile. Capable of being drawn in or back, as a cat's claws.

Rodent. An animal of the order Rodentia, which includes the rats, squirrels, beavers, etc. Their incisor teeth are specially adapted for gnawing.

Rostrum. Snout, beak, or proboscis.

Rufous. Brownish red; rust-colored.

Ruminant. Chewing the cud. A cud-chewing animal.

Species. A group of animals possessing in common certain characters which distinguish them from other similar groups; a distinct sort or kind of animal.

Subspecies. A variety or race; a form connected with other forms of a species by individuals possessing intermediate characters.

Subterranean. Under the surface of the earth.

Tarsus. The ankle; the bones between the toes and the heel; the shank of a bird's leg.

Taxidermist. One who prepares, stuffs, and mounts in lifelike form the skins of animals.

Terrestrial. Inhabiting or belonging to the ground or land in distinction from water, trees, etc.

Tibia. The larger bone between the knee and the ankle.

Tine. A prong of an antler.

Tuberculated. Having tubercles, that is, small knob-like prominences on some part of an animal.

Type. Typical form. A type species is that form used as the basis of the original description of a species. A type genus is that genus from which the name of the family or subfamily to which it belongs is formed.

Ulna. The inner or back one of the two bones of the forearm.

Ungulate. A hoofed quadruped.

Vertebra [plural, **vertebræ**]. One of the segments of the backbone or spinal column.

Vertebrate. Having a spinal column or backbone. One of the large division of animals called the Vertebrata.

Vinaceous. Wine-colored, especially of the color of red wine.

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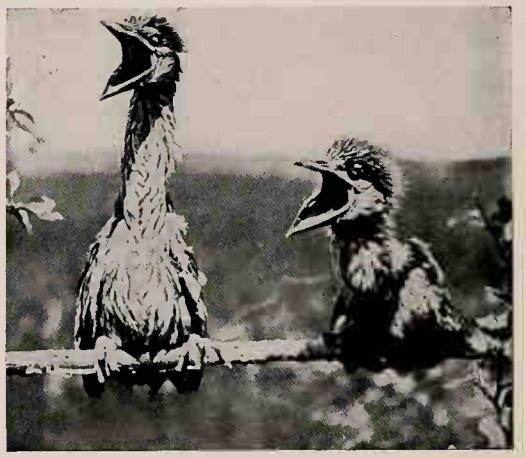

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